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PLASTICS TECHNOLOGY

THE MAGAZINE OF APPLIED ENGINEERING

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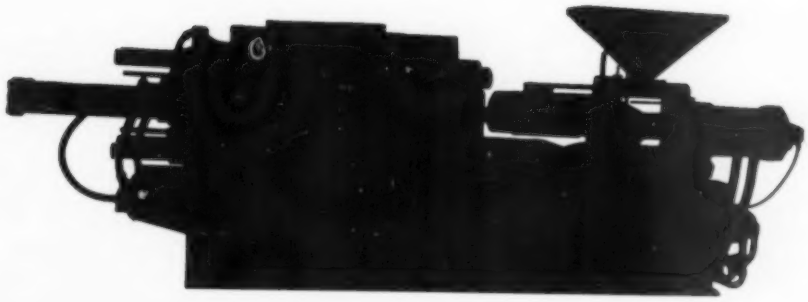
FACTS ON 1958 INJECTION MOLDING MACHINES



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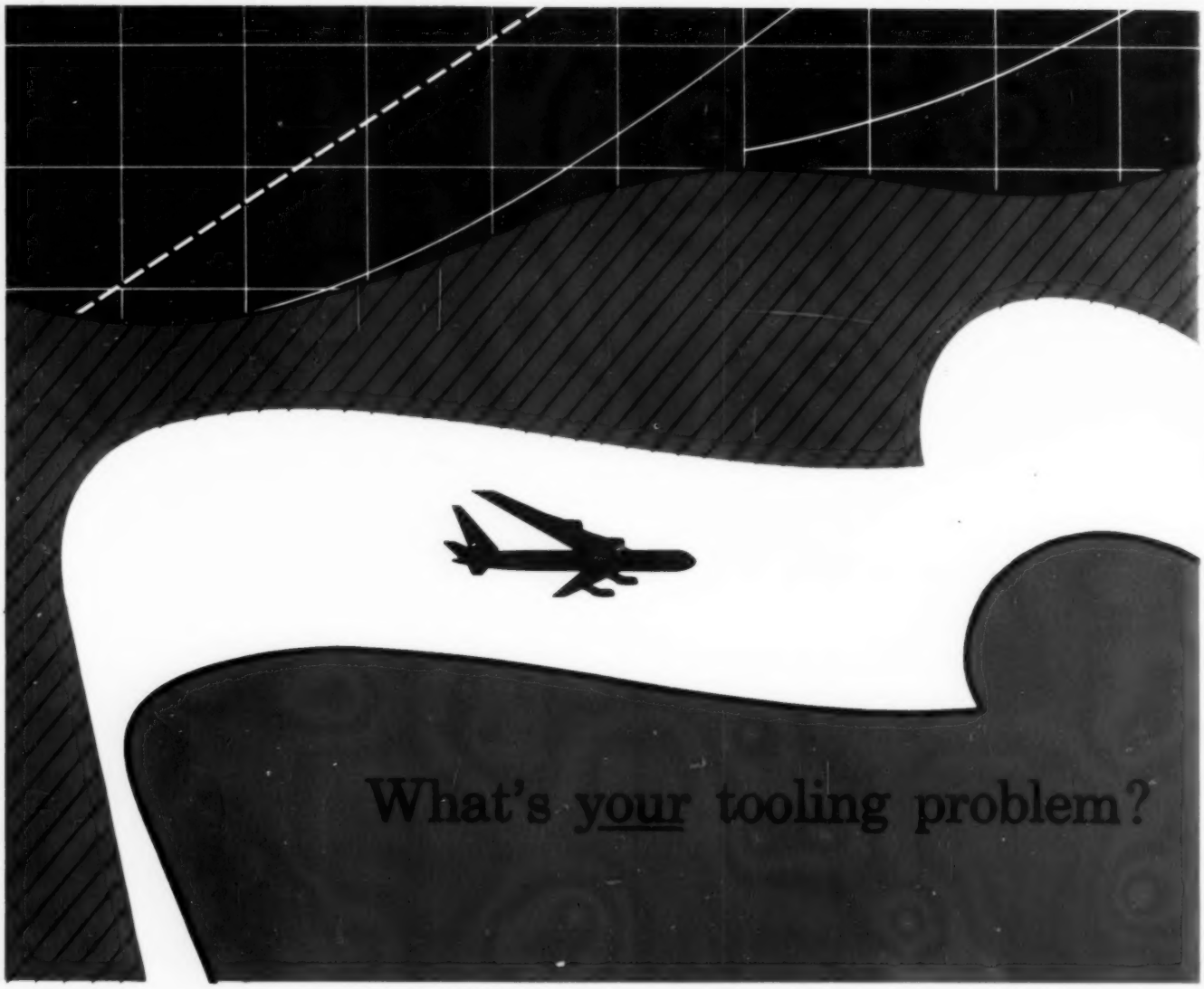

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PLASTICS TECHNOLOGY

THE MAGAZINE OF APPLIED ENGINEERING

MAY 1958 VOLUME IV NUMBER 5

396 ARTICLE HIGHLIGHTS and PREVIEWS

427 **EARLY DETECTION OF WEATHERING DAMAGE IN POLYETHYLENE**
J. W. Tamblyn, G. C. Newland and M. T. Watson

Results are given for a lengthy series of tests to determine weathering damage to polyethylene by three methods of detection.

433 **END-USE CORRELATION OF STYRENE CONTAINER TESTING**
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448 **OPTIMUM AROMATIC AMINE-HARDENED EPOXY-GLASS LAMINATES**
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The opinions expressed by our contributors do not necessarily reflect those of our editors

Previews of Next Month

The following articles will be published in the June issue:

Mold Design for High-Density Polyethylene. Albert Spaak, Applied Arts Supervisor, Tech. Service Lab., Polymer Chemicals Div., W. R. Grace & Co., Clifton, N. J.

Dielectric Heat-Sealability of Films. G. I. Addis, L. A. Rosenthal, and E. Flowers, Development Dept., Bakelite Co., Bound Brook, N. J.

New Techniques for Molding Linear Polyethylene. D. A. Jones, Celanese Corp. of America, Newark, N. J.

Dry-Coloring Methods for Injection Molding of Polyethylene. J. N. Scott, C. J. Silas, and J. V. Smith, Phillips Chemical Co., Bartlesville, Okla.

•

Highlights of this Issue

Early Detection of Weathering Damage in Polyethylene. (p. 427)

Three methods of detecting early weathering damage in polyethylene are described and discussed (formation of ketonic carbonyl groups, development of cracks in stressed specimens; and loss of tensile enlongation). In unprotected formulations, carbonyl formation did not always correlate well with stress cracking or loss of elongation, but can correlate well with the other two measures of breakdown.

End-Use Correlation of Styrene Container Testing. (p. 433)

Some areas of field performance conditions for styrene containers correlate with laboratory tests, but there are areas where test correlation can be improved and where new tests should be developed.

What a Plastics Enginer Should Look For When Planning to Buy an Injection Molding Machine. (p. 439)

Planning should be made as far in advance as possible, and should involve proposed use of the machine, principal specifications needed, optional equipment desired, maintenance and service, plant layout preparations, financial arrangements, and related considerations of importance.

Optimum Aromatic Amine-Hardened Epoxy Glass Laminates. (p. 448)

Data are given to show that average edgewise compressive strengths of 48,000 psi., with tangent compressive modulus of 3.8-million psi., can be achieved consistently by press molding pre-impregnated, B-staged, glass cloth-reinforced epoxy laminates, using conventional equipment and molding at 250° F. and 50 psi., and postcuring for two hours at 300° F.

Letters to the Editor

Reply to Inquiry on Plastic Vaults

Dear Mr. Esposito:

In reference to your letter seeking a source of supply for plastic vaults, I would like to offer a suggestion: Why don't you make your own?

About a year or so ago, prior to my affiliation with DeBell & Richardson, I had an occasion to act as consultant to one of the large midwestern vault manufacturers. His problem was one of treating concrete vaults with fiberglass-reinforced resins. I did, however, get a pretty good idea of what the reinforced burial vault picture was like.

At that time, we suggested an all-reinforced vault that could not only replace the concrete vault, but would be far superior to it in many ways. It would be light enough for one or two men to handle. It might be considered in some respects as strong, or possibly with fillers, laminations, or cores, as durable, and certainly it would be more attractive than the massive concrete vault.

Pricewise it would be more expensive, but actually there is no fair comparison of one item with the other. You save on the price of a full truck and crew in installation. You save on shipping costs; but it is more expensive to build. A client whose eye appeal is satisfied is willing to pay more for 'the very best.'

We feel sure that there are a few companies manufacturing vaults, but feel sure that with their markups for profit and overhead, you might be priced out of the market unless you build your own. Actually it is not too difficult a process for you to set up a captive operation if you are interested in producing an appreciable quantity of these units.

If you are interested, we can propose a method by which we can be of service to you, both in the development of a satisfactory vault and in the setting up of a plant for its manufacture.

Armand G. Winfield
DeBell & Richardson, Inc.
Hazardsville, Conn.

(This is in reply to Mr. Esposito's "Letter to the Editor" in our April issue, pg. 306. We are printing it to remind our readers of the benefits that could be obtained by the use of appropriate consulting firms to answer specific questions.—Editor)

Award Nominee Proposed

Dear Sir:

I just read your editorial announcing "Achievement Awards in Plastics Technology" in the March issue, and I think it is an excellent idea.

I would like to submit the following for consideration:

General Electric Co.
Brockport, N. Y.
Attn: Mr. Tom Taylor

for automating a fry pan handle.

There are thousands and thousands of various appliance handles for fry pans, steam irons, sauce pans, pressure cookers, oven doors, etc. which have been transfer molded for years. Until General Electric disregarded all previous procedure and redesigned the part for automatic molding, no handle had ever been automatically molded.

Few companies have the foresight to do what they have done. Parts had to be redesigned, new compression methods studied, new molds purchased, and new automatic presses purchased. Too many pursue things through the planning stage and then drop the project. G-E followed it through, eliminated labor and expensive transfer molding operations, and cut costs substantially. They produced a first in the industry.

In our consideration, this is a real break-through for sound plastics economy—redesign for the new automatic equipment that is now available. We were proud to have been included in the overall program.

N. W. Oberle, Sales Mgr.
Plastic Press Division,
Baker Brothers, Inc.
Toledo, Ohio

(We print this letter to remind our readers that the Achievement Award Program for 1958 is under way, and to submit nominations.—Editor)

We invite letters from our readers for publication in these colums. Such letters may be of comment or criticism, requests for information, or of general interest. The only requirement is that all letters must be fully identified as to name of sender, company affiliation and address.

A letter will not be printed if publication is not desired by the sender, and the identity of the writer will be withheld, if desired.

—The Editor

"Quote . . . Unquote"

Scientific Manpower Needs

"There is in the United States today a tight supply of skilled and professional workers of many types. This situation has created a high demand for scientists and engineers by intensifying the trend toward the substitution of machines for manpower. More men are needed to design, build and supervise operation of new equipment.

"The insatiable desire of Americans for new and better products is demanding an ever-increasing stream of scientific discoveries. The trend toward national self-sufficiency in key raw materials is spurring research in man-made substitutes. The needs of national defense call for tremendous increases in atomic and electronic research and development.

"All of these multiply the need for scientists and engineers. The current problem can be traced to:

(1) The decline in recent years in the total number of people reaching the age when they might enter the fields of science and engineering.

(2) The decline in the percentage of eligible people who actually choose to embark on a career in science and engineering.

(3) The continued expansion of the demand for scientists and engineers growing out of our continuing technological expansion.

"The number of people reaching college age (18-24) when they might choose a career in science and engineering has been declining steadily for the past 12 years. This, of course, can be traced to the large drop in the birth rate during the depression decade of the 1930's. However, since 1946, the number of births has exceeded 3,750,000 each year. This means that our college age population will rise significantly in the years to come.

"By 1965, our total population should be 15% above that of 1955. And, remember, 1955 was the best year in the history of our . . . economy from the standpoint of employment, gross national product and industrial production.

"It is apparent that increasing the percentage of students who attain degrees in science and engineering is the most effective way of heading off a serious engineering manpower problem.

"This is not an insurmountable task. Today, 18.6% of those who are graduated are scientists and engineers. In order to provide a supply of scientists and engineers to balance the demand, this percentage should be raised to 20-22% each year through the next decade."

"A Study of the Scientific Manpower Problem of the United States," The B. F. Goodrich Co. Akron, Ohio

Quality up, cost down in new molding process for GREX*

HIGH DENSITY POLYETHYLENE

This dishpan was molded from GREX high density polyethylene by an important new process . . . a Pre-Compressed Molding process resulting in highly superior products, coupled with substantial dollar savings because of greater economy of operation.

Pre-Compressed Molding

In this new molding process, the gates contain valves that are closed as the injection takes place, and the material in the heating chamber is then compressed to the maximum pressure for molding. At optimum pressure the valves are opened and the plastic material pours into the cavity at high velocity and pressure. The valves are then reclosed and the finished part is ejected without sprues or gates.

Advantages Over Other Processes

Several years of actual production experience prove that this new molding process offers the plastics industry many significant advantages.

It makes possible bigger, deeper molds with larger surface areas, using considerably smaller machines than with conventional gating; as well as greater molding speeds on larger machines.

It greatly improves the physical properties of the finished parts, particularly in impact strength. Parts are freer from stresses, poor welds, trapped air and cracks. The usual weakness around sprues or side gates is eliminated. The finish on parts made from GREX high density polyethylene and other thermoplastic molding materials is noticeably improved.

The process cuts scrap losses by decreasing short shots and eliminating sprue cracks and bubbles. No gates or sprues to be trimmed means reduced finishing costs. And since molding temperatures are lower, there is virtual elimination of warpage, shrinkage marks, material breakdown or color variations.

And not the least of valve gating advantages in molding GREX is the almost invariable reduction in the molding cycle, especially where large area parts with thin wall sections or large-draw parts are being molded. For such parts the time cycle is usually from one-half to two-thirds shorter than with conventional methods.

Putting this Process to Work for You

The Pre-Compressed Molding process for GREX high density polyethylene and other thermoplastic molding materials can help *you* make better products . . . at lower cost. GRACE's Polymer Chemicals Division has been licensed exclusively under patents held by Columbus Plastics, and in turn GRACE will sub-license plastic molders so that the benefits of this new process may be made widely available.

All basic plastics engineering principles apply to the Pre-Compressed Molding method. Polymer Chemicals Division has a wealth of experience in the applications of this new process.

Write today for your copy of a comprehensive booklet on Pre-Compressed Molding.

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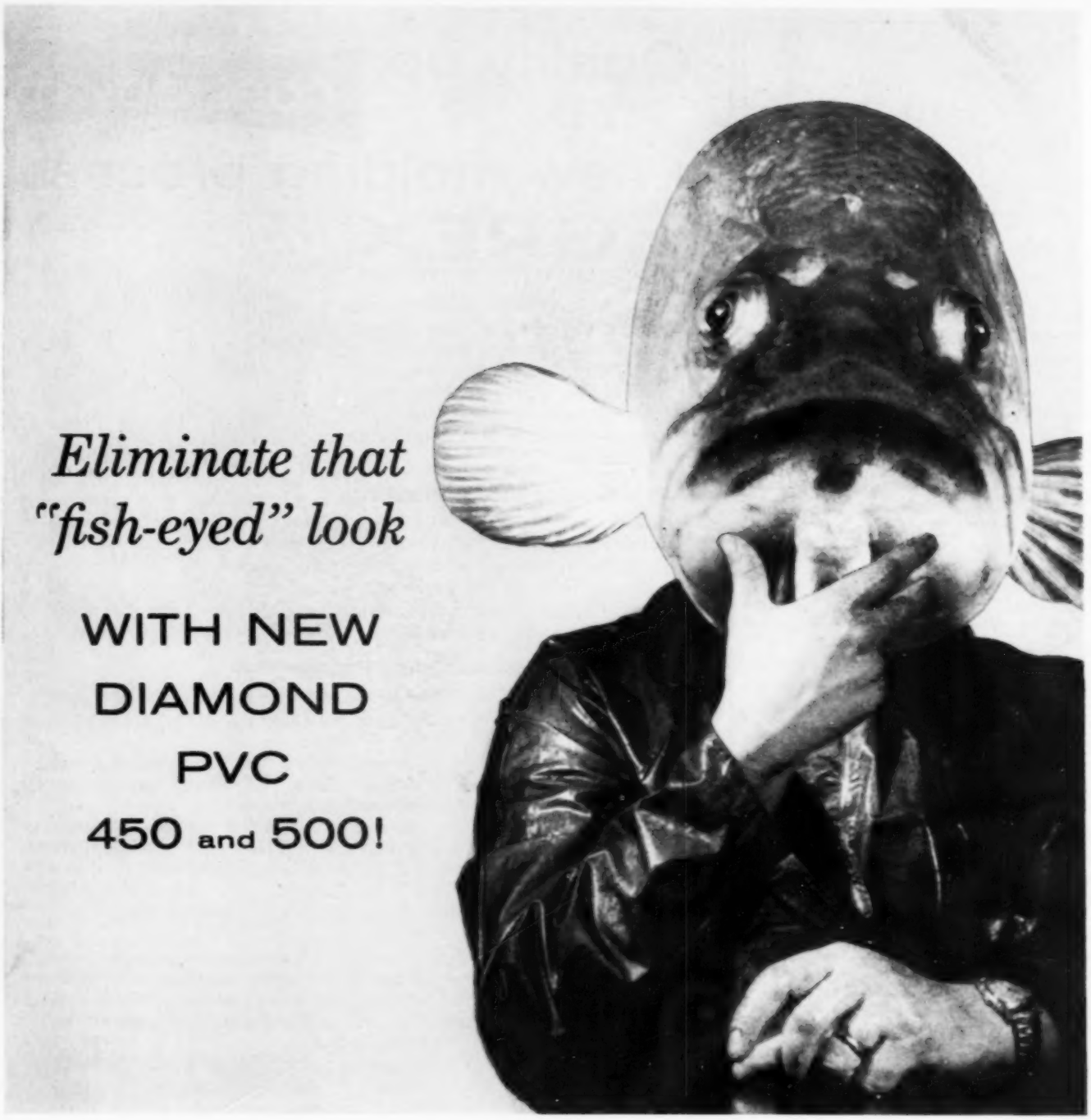


Fish-eyes in your vinyl film result in "fishy-eyed" customers, too. Now, Diamond has two new resins—PVC 450 and 500—engineered to meet your need for a vinyl chloride polymer with improved clarity, fast dry blending and extrusion rates, better heat stability . . . and fewer "fish-eyes"!

These new resins have high colloidability and plasticizer absorption characteristics, outstanding processability.

Your Diamond representative will give you the full story. Call him today or write Diamond Alkali Company, 300 Union Commerce Building, Cleveland 14, Ohio.

Typical analysis characteristics include:

	PVC 450	PVC 500
Color	White— *fine powder*	White— *fine powder*
Specific Viscosity	1.35	1.50
Bulk density	0.47 gr/cc	0.46 gr/cc-30#/ cu. ft.
Plasticizer Absorption	35	32

Diamond Chemicals

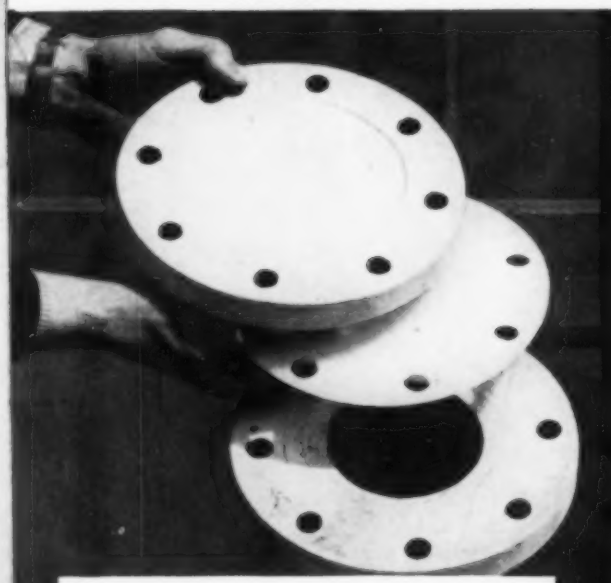
IDEAS IN THE MAKING WITH
CIBA ARALDITE EPOXY RESINS

SHIPPING TUBES manufactured with CIBA Araldite® Epoxy resins and glass get to the "core" of a problem for major petroleum producer.

THE PROBLEM

Between drilling locations in the Middle East and geological laboratories in Oklahoma are many costly air-freight miles over which to speedily transport heavy core samples for analysis.

THE SOLUTION



Shipping tubes like this made of Araldite Epoxy and glass weighing only 17½ pounds now replace 300 pound steel tubes. Not only do the Epoxy-glass tubes provide the light-weight strength with safety required but also provide the necessary non-contamination without special coating so that sample liquids could be shipped with core samples.

THE RESULT

Core samples and liquids are now flown in from all the far-flung drilling locations of a major oil company at a 1 to 17 saving in air-freight costs.

Shipping Tubes produced by Ed Conley Plastic Corp., Tulsa, Oklahoma.

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Please send me full information on CIBA Epoxy Resins for tubing applications ☐

I am also interested in Epoxy Resins for

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In the U. S. and Canada, CIBA produces basic resins only.

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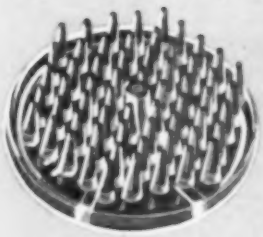
The STYRENE for

Insulated beverage server molded from C-11 (for resistance to heat and food stains) by N. F. C. Engineering Company. Clockwise: "Carpetmates" furniture caster, capable of withstanding compression loads up to 3,500 pounds, molded of C-11 by Childlore Company. High-gloss, easy-clean meat grinder bowl molded for Nutone, Inc. by Meridian Plastics, Inc. High voltage TV chassis socket molded by Breyer Molding Company for RCA. Lubricating oil sight-glass bowl undergoes 1,200 psi pressure, with C-11 molding by Chaney Plastic Molding Company for C. A. Norgren Company.

strength... BAKELITE BRAND C-11 PLASTIC

Plus—



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★ **Smooth Finish**
★ **Good Dielectric Properties**

This acrylonitrile-styrene copolymer is a thermoplastic molding material with properties of chemical resistance and strength *superior* to those of ordinary polystyrenes. These make it particularly suitable for articles such as tumblers, cups and many others which, in previous materials, have been subject to breakage and chemical attack.

The superior performance characteristics of BAKELITE Brand C-11 Styrene are described in technical literature available by writing Dept. PT-26 —or calling your Bakelite Technical Representative.

TABLE OF PROPERTIES (RMD-4511)

Values Relating to Fabrication

Specific Gravity (D792-50)	1.07 (Varies slightly with color)
Weight per Cubic Inch (Molded) gms.	17.5
Bulk Factor (D1182-54) Diced	1.98
Pellet	1.71
Molding Shrinkage (D955-51), in./in.	0.004

Values from Mechanical Tests

Izod Impact Strength (D256-54T) ft.-lb./in. of notch	
⅛ in. thick	0.55
¼ in. thick	0.45
Tensile Strength (D638-52T), psi	12,000
Elongation in Tension (D638-52T), per cent	3.2
Flexural Strength (D790-49T), psi	17,300
Modulus of Elasticity in Flexure (D790-49T), psi	5.2×10^5

Values from Miscellaneous Tests

Heat Distortion Temp. (D648-45T) (¼ in. thick, 264 psi) deg F.	200
Thermal Coefficient of Linear Expansion (D696-44) per deg. C.	7×10^{-5}
Water Absorption (D570-54T), per cent gain in weight in 24 hours	0.23
Rockwell Hardness (D785-51)	M83

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- **UNIFORM WALL SECTIONS** uniform heat transfer — uniform heating — no hot spots — no place for plastic to hang up — positive joint seal!
- **PROVEN** in nearly 1000 installations on every make and model of injection machine.

Send for our Heater "How Book" today. It tells about the men and materials that combine to give you IMS Standardized Design Replacement Heating Cylinders.

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IMS offers 2½ to 3 weeks delivery on Quality Replacement Heating Cylinders, engineered to meet your requirements.

More Capacity? Less Capacity? Nylon Shut-off Type—Mixing Type? Vinyl? Write Today!

Cut your press downtime — cut your maintenance costs. Have your foreman send us the few simple measurements we need to build a Uniform Design Heater for your specific press. Do it NOW!

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Hospitals will welcome this new lightweight sterilizer tray made of heat-resistant MARLEX . . . withstands sterilizer temperatures up to 250° F. for hours!

MARLEX tote boxes filled with chickens moving into this quick-freezer easily withstand repeated freezing and steam cleaning, as well as the usual severe production-line handling.

The best tote boxes are made of MARLEX*

RIGID POLYETHYLENE

. . . lightweight, unbreakable, low in cost!

"We picked Marlex because it has what it takes to deliver satisfactory service in restaurants, cafeterias, hotels, hospitals, and the institutional food field," says Daniel Bloomfield of Bloomfield Industries, 4546 West 47th Street, Chicago 32, Ill.

"Here is a tough, rugged plastic that is completely sanitary," Mr. Bloomfield points out. "You can put our new Marlex All-Purpose Dish Boxes and Silverware Trays through commercial cleansing procedures.

"Marlex doesn't stain from oils, fats or greases. It won't dent, either. So this equipment keeps its good looks. And the price is right."

Injection-molded restaurant equipment is just one of many profitable applications for Marlex polyethylene.

No other type of material can serve so well and so economically in so many different uses.

For more information, get in touch with your local Marlex sales representative.

*MARLEX is a trademark for Phillips family of olefin polymers.

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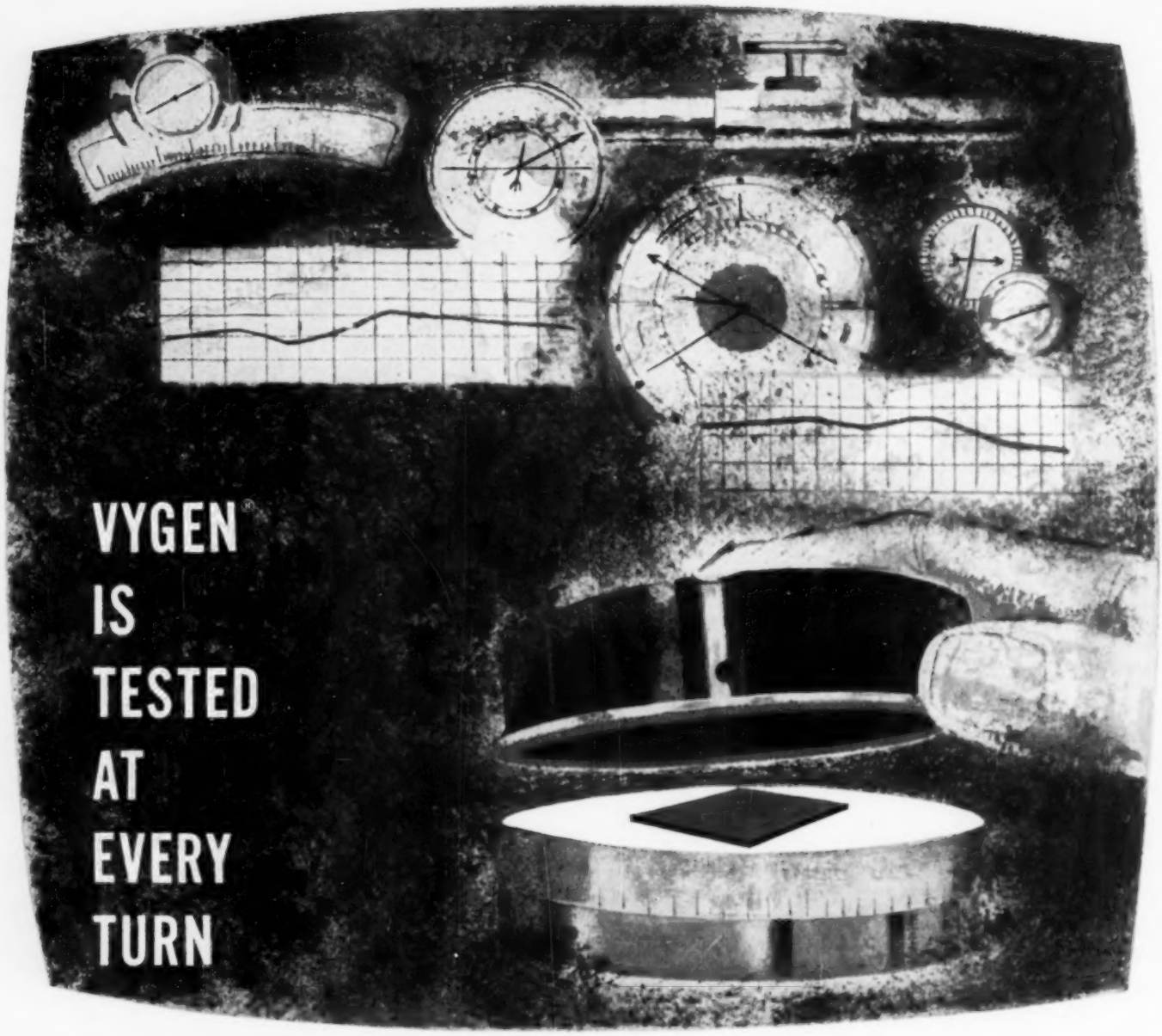

. . . to assure top quality and uniformity in your product

From raw materials through glass-lined equipment to your plant —every phase of the Vygen production operation is planned and supervised through extensive testing to give you a perfect product. Outstanding quality and absolute uniformity makes Vygen resins and compounds right for any job, regardless of size, equipment or technique. Vygen is carefully checked before you get it, to make sure your finished goods are the very finest.

Both application-tested and UL-approved, these two members of the Vygen family are ideally suited for wire insulation and jacketing. Specify the one that fits your requirements.

VYGEN 120 resin — For fast, flawless dry-blend extrusion, using monomeric or polymeric plasticizers. It has a narrow range of particle-size distribution, fast rate of solvation, and outstanding heat stability.

VYGEN 6812 compound — Pelletized, ready for extrusion in black, white, or natural. Proved for 60° C T&TW in oil and 80° C appliance wiring applications, this material has a specific gravity of 1.32 and takes to the toughest jobs with ease.

SPECIFY VYGEN 105 FOR MOLDED PLUGS
Tested and approved under every condition, Vygen 105 is ideal for molded plugs because it combines good heat stability with good flow properties.

Creating Progress Through Chemistry

Chemical Division
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THE GENERAL TIRE & RUBBER CO.
VYGEN®

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PLASTICS TECHNOLOGY

MAY, 1958

EDITORIAL: Guest Editorials Invited

A standard feature of PLASTICS TECHNOLOGY since its inception has been the monthly guest editorial contributed by company spokesmen or other individuals in the plastics industry.

Some of our guest editorials to date have been entirely unsolicited—in fact even unexpected. Others have been contributed at our express invitation to the authors that they enlarge or expand on comments they had made previously in letters.

In line with the editorial changes and improvements made or planned in the magazine this year, we would like to discuss the functions of our guest editorials, and invite their contribution from our readers.

•

We look upon the guest editorials as providing a sounding board whereby any responsible person in the plastics industry, speaking either for himself or on behalf of his company, can express any thoughts or opinions that he considers worthy of attention and further publicity by our readership.

Interest to the readers is the only requirement. While the guest editorial can be on any subject, technical or non-technical, it should be borne in mind that our readers are essentially technical in nature by virtue of education and/or training. As such, the subject of the guest editorial should have special meaning or significance to these readers.

An important point to be emphasized is that guest editorials are not subject to any censorship, expressed or implied, on our part. They are edited only for grammar, punctuation, sentence structure, etc., designed to help the author present his viewpoint as clearly and as forcefully as possible. This, whether we agree with his viewpoint or not!

If in the course of this editing we come across a statement that could prove detrimental to the author, his company, or any other firm or segment of the industry, we will so inform the author and suggest a remedial change. This change is only a suggestion, and will not be made in the final printed version unless first approved by the author. If the suggested change is not approved, the original wording will be retained. In other words, all editing performed is done to best serve the author's interests.

Finally, the guest editorial can range from 750 to 1,500 words in length. When published, it is accompanied by the name, title, company affiliation, and photograph of the author.

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We invite you, our readers, to prepare guest editorials for publication in the magazine. The only request we make is that we be advised of the subject and expected date of availability of your proposed guest editorial. This information will help resolve any conflicts in subjects, and permit early publication of your guest editorial when it is received.

The rest is up to you!

Arthur M. Merrill
Editor

This is a reprint of a "Guest Editorial" invitation originally published in February 1957, and is designed to remind potential Guest Editorial writers in the plastics industry of their opportunity to present worthwhile and important subjects to our readership, the technically trained and/or educated persons responsible for developments in plastics technology.

hi-fax®.. the high-density

Looking at high-density polyethylenes for improved products and lower costs? Then be sure to check Hi-fax.

Here's why Hi-fax is different:

Hi-fax, as produced by Hercules' exclusive process is different in nature and performance from all other high-density polyethylenes. It is formulated at a density which provides optimum performance in terms of the key properties you need.

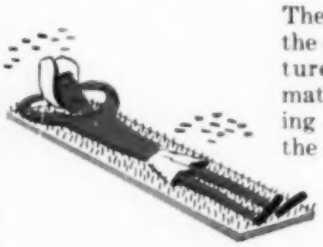
Different because: Temperature Resistance

From boiling water to sub-zero temperatures, Hi-fax retains its dimensional stability, flexibility, and impact strength. Nontoxic, too, it's the ideal plastic for housewares, containers, toys, and food packaging.

Different because: Lightweight

Providing rigid strength in thin-wall sections, Hi-fax, lightest of all high-density polyethylenes, yields extremely lightweight, highly functional structures.

Different because: Rigidity



The stiffness of Hi-fax permits the design of thinner wall structures, substantially reducing material costs without sacrificing appearance or function in the end product.

Different because: Toughness

Unbreakable and abrasion-resistant, Hi-fax provides a sturdy, low-cost plastic for heavy-duty industrial applications, mechanical uses, pipe, wire and cable, film and paper coatings.

Different because: Stress-Crack Resistance

No other high-density polyethylene can match the stress-crack resistance of Hi-fax. This key property makes Hi-fax the preferred polyolefin in detergent packaging, wire and cable coatings, and any other uses where resistance to embrittlement due to atmospheric or chemical exposures is important.

HERCULES

THREE NEW MATERIALS FOR THE PLASTICS INDUSTRY

Hi-fax High-density polyethylene • Pro-fax* Polypropylene

Penton® Chlorinated polyether

*Hercules trademark

polyethylene that's different

Need a custom-built high density polyethylene exactly tailored to your market?

Only Hi-fax gives you a choice of 7 end-use types.

1. Injection Molding

A broad selection of injection molding types offering the optimum in physical properties, moldability, color and finish in four different melt index ranges.

Royal thermos jug has base, cap and handle molded with Hi-fax by Avsco Inc., Excelsior Springs, Missouri.

2. Blown Containers

The only high-density polyethylene especially formulated for blow molding. Produces lightweight, thin-wall containers with outstanding heat, chemical, and stress-crack resistance.

Another first for Hi-fax! Thermoplastic syrup jar at left molded by Royal Manufacturing Co., Prescott, Arizona, for Maynard Manufacturing Co., Glendale, California.

3. Pipe

An exclusive Hercules formulation, based on more than three years of laboratory and field testing, designed to yield better plastic pipe at lower cost.

Hi-fax can be fabricated in conventional equipment, yields uniform wall thicknesses even in large diameter pipe.

4. Extrusion

Your choice of four extrusion grades specifically formulated to provide the combination of physical and mechanical properties required in your process and products.

By using Hi-fax tubing in its sash balance assembly, Unique Balance Company makes an already fine product an even better one.

5. Wire and Cable

Three special grades providing outstanding abrasion and stress-crack resistance, the two properties most important to the electrical industry.

Hi-fax produces low-cost plastic-coated tree wire capable of withstanding rugged, long-term exposures to abrasion and weathering.

6. Film and Paper Coating

Special grades with excellent workability, acceptable for direct contact with foods, and yielding low-cost films and paper coatings.

7. Monofilament

Resins which yield rope, cordage and fabrics with excellent "hand" and "feel", high tensile strength, abrasion resistance, flexibility and washability.

Cellulose Products Department

HERCULES POWDER COMPANY

INCORPORATED

900 Market Street, Wilmington 99, Delaware

CP58-3

CURIOSITY THAT'S BRED IN THE BONE

There's a hidden ingredient in every Argus product. It's the basic, bred-in-the-bone curiosity about your problems that enables Argus research to keep turning out better and better vinyl plasticizers and stabilizers at lower and lower cost.

Many of Argus' superior products have been developed, or improved, in the course of finding answers to specific technical problems posed by customers. The reason: every member of the Argus research staff is a recognized authority in the vinyl field.

If you want the *right* answers, ask Argus. We'll find them for you in our regular line of Mark stabilizers and Drapex plasticizers — or in basic, original research done on your product by our Technical Service Staff. Write for technical bulletins and samples.

ARGUS CHEMICAL CORPORATION / New York and Cleveland

Main Office: 633 Court Street, Brooklyn 31, N. Y. Branch: Frederick Building, Cleveland 15, Ohio

Rep's.: H. M. Royal, Inc., 4814 Loma Vista Ave., Los Angeles; Philipp Bros. Chemicals, Inc., 10 High St., Boston; H. L. Blachford, Ltd., 977 Aqueduct St., Montreal.

U.S.I. POLYETHYLENE NEWS

A series for plastics and packaging executives by the makers of PETROTHENE® polyethylene resins

JUNE-JULY 1959

Packaging Notes

New Surface Treatment for Polyethylene uses fluorine to make poly bottles and containers substantially impermeable to gases and volatile chemicals. The fluorination process, described in a recent patent, may make possible polyethylene packaging of such items as liquid cosmetics, aromatic solvents, oils and aerosol formulations.

The fluorination process is claimed to be simple and economical. Film or bottles, washed free of foreign matter, are brought in contact with pure fluorine or a fluorine gas mixture at room temperature or at up to 50°C. In a typical test, loss of a volatile liquid was claimed to be reduced from 5.67% in an untreated bottle to .05% in a fluorinated bottle over the same period of time. In another test, treated film transferred less than a sixth as much oxygen as untreated film. Other properties of polyethylene are said to be unchanged by the process.

Tear Tape Opening for polyethylene coated package is being used by one manufacturer. Product is packaged in a poly-coated aluminum foil pouch with a 3-lb. cotton thread applied as part of the extruded poly coating. It is believed that this method may be used with equal success on packages of unsupported polyethylene film.

Two New Appointments Announced by U.S.I.

John K. Moffett, Jr.

William H. Rader

John K. Moffett, Jr. has been appointed Assistant Manager of PETROTHENE® Polyethylene Sales. Mr. Moffett has been employed by U.S.I. since 1948 in various production and sales capacities, and has served recently in a sales development position for PETROTHENE resins.

William H. Rader has been made Assistant Production Manager for PETROTHENE resins. As Senior Development Engineer Mr. Rader has been in charge of polyethylene development operations at U.S.I's Tuscola plant.

Film Can Be Drawn Down To Less Than 1/4 Mil With New Medium Density Petrothene® Resin

Provides Added Safety Margin at Commercial Film Thicknesses

Super-thin (0.2 mil) blown film of PETROTHENE 239-27 is so light it virtually floats in air.

U.S.I. has introduced a new medium density polyethylene resin that makes possible extrusion of film in thicknesses as low as 0.2 mil. While few commercial uses exist for film of this gauge, the new resin offers a greater margin of flexibility during extrusion at conventional thicknesses such as 0.4-0.5 mil.

The new resin, called PETROTHENE 239-27, has a density of 0.929, placing it in the medium density polyethylene range. Film made from it has increased stiffness, with excellent gloss and clarity. This high clarity, and the ease with which low thickness film can be extruded, is expected to make the resin of particular value in thin film applications such as drycleaner garment bags.

Stiffness Makes for Easier Handling

The new resin brings an added advantage to the manufacture of garment bags:

Film extruded from it has a high degree of stiffness and has less tendency to cling to garments. In soft goods packaging, this added stiffness makes for easier handling on the packaging line. Packages and bags made with the lighter gauge film are also easier to tear open.

Extruders may obtain specifications and other technical data on PETROTHENE 239-27 resin by writing to PETROTHENE Polyethylene Dept., U. S. Industrial Chemicals Co., 99 Park Avenue, New York 16, N. Y.

Group Begins Second Year Of Plastic Pipe Promotion

The Plastic Pipe Research Council recently outlined the second-year plan for its NSF (National Sanitation Foundation) plastic pipe program.

Cornerstone of the Council's promotion is a research and information program which includes producing slide films, placing informative articles in leading consumer and industrial publications and a brochure entitled, "Safe Transportation of Drinking Water—Your Key to Public Health." The promotional campaign is aimed at persons and organizations who buy, specify or permit the use of plastic pipe approved for transmission of drinking water. It is supported by a group of pipe manufacturers and raw materials suppliers, including U.S.I.

Booklet on Resin Quality in Housewares is Offered

A 24-page illustrated booklet containing tips for plastic housewares buyers is now available from U.S.I. The booklet, "The Goose That Laid the Golden Egg," emphasizes the importance of resin quality and good production practices in maintaining the market for polyethylene housewares. It points out what guides to judging quality are available to the buyer. Copies of the booklet are available to polyethylene molders for distribution to their customers. Write Editor, U.S.I. POLYETHYLENE NEWS, 99 Park Avenue, New York 16, N. Y.

Extrusion Coaters Report Large Increase In Facilities

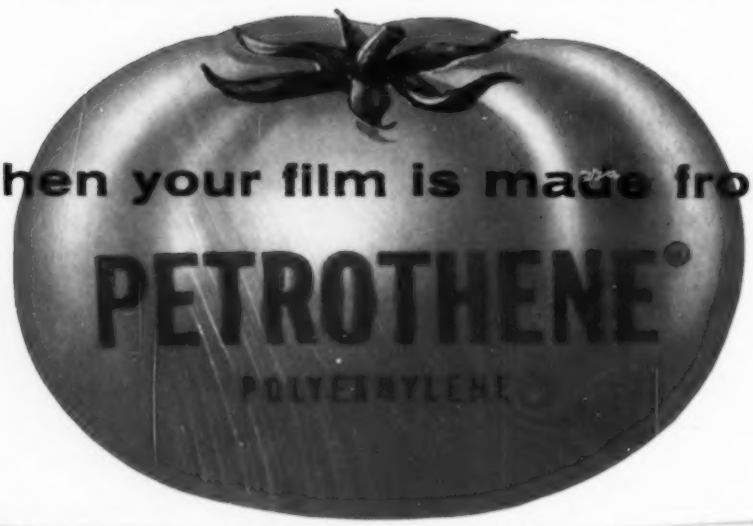
The number of extrusion coating machines in the U. S. has risen to approximately 45, according to a recent report by the Polyethylene Extrusion Coaters Group of the Specialty Paper and Board Affiliates.

The large increase over the number of facilities available three or four years ago can be attributed to rapid growth of uses for polyethylene coated paper, board, film and foil in the food, dairy and industrial packaging industries, and increasing consumer acceptance of polyethylene coated containers.

IN THIS ISSUE:

P. 2 — High Clarity Film
P. 3 — How to Avoid Wrinkling in Blown Tubing
P. 4 — Fastest Growing New Film Market

VISIBILITY UNLIMITED



● Blown film from regular production run using a PETROTHENE Polyethylene resin. Film is 1 mil thick—Other films may be drawn down to as low as 0.2 mil.

. . . and Clarity is only one of the advantages offered by PETROTHENE® Resins - -

PETROTHENE polyethylene resins permit you to offer your customers film with the characteristic toughness of polyethylene, plus clarity and gloss in the same range as conventional transparent packaging materials. And at the traditionally low cost of ordinary polyethylene, PETROTHENE resins give you these extra advantages:

Improved Toughness/Clarity Ratio

As you know, the more toughness you require in polyethylene film, the less clarity you can expect. With clear PETROTHENE resins, however, you get a more favorable toughness/clarity ratio than with ordinary polyethylenes. For example, at the same level of toughness, PETROTHENE resins offer a higher degree of clarity; at equal clarity, PETROTHENE resins have more toughness. In addition, PETROTHENE resins offer you a complete range of variations in toughness and clarity to suit any end use your customers specify.

Unusually Good Draw-down

You can draw some PETROTHENE resins down to 0.2 mil. While few commercial applications require gauges as thin as this, the figure indicates the margin of safety which PETROTHENE resins give you at conventional thicknesses. PETROTHENE resins can also be extruded into thicker film or sheet.

Hold up a film made from U.S.I. PETROTHENE polyethylene and look at any distant object through it. Then do the same with any other polyethylene film of similar thickness. This simple test will demonstrate the outstanding transparency of film made from PETROTHENE polyethylene resins.

U.S.I. technical representatives will be glad to work with you to obtain the best possible film properties and production rates with PETROTHENE resins. For sample or information on PETROTHENE resins, write to:

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corp.
99 Park Ave., New York 16, N. Y.
Branches in principal cities

U.S.I.

Vol. III No. 3

POLYETHYLENE PROCESSING TIPS

HOW TO AVOID WRINKLING IN EXTRUSION OF BLOWN TUBING

Wrinkles in blown polyethylene tubing on the windup roll is a problem that plagues even the most experienced extruders. It occurs intermittently in almost every shop, and may usually be avoided by one or more of the following measures.

Die Adjustment

Be sure the die opening is adjusted properly. If it is out of alignment, it can cause gauge variations which result in an uneven pull at the nip rolls and subsequent wrinkling on the windup. Uneven or thin gauge at the sides of the ascending tube may show as chevron-type wrinkles on the edge of the roll.

The improper adjustment of the die opening or orifice, or a frost line which is not level, may cause a condition known as bias – a greater or smaller distance around one half of the tube than around the other half – and results in a surplus of film to the front or rear on the windup. Ruffle-like wrinkles across the center of the lay flat width are characteristic of a bias condition.

Film Temperature Control

If the frost line is too high the blown tube is difficult to control and may cause poor gauge control around the circumference of the tube and uneven gauge in the film. This in turn could lead to an unbalanced pull in the nip rolls or across the collapsing guides and result in wrinkling. The frost line can be lowered by slowing down the rate of extrusion, reducing melt temperature or increasing cooling.

If the film is too cold when it reaches the nip rolls, it may be overly stiff and subject to crimping. The temperature may be increased by increasing the screw speed, lowering the height of the rolls or stepping up the extrusion and take-off rates. Temperature increases must be made cautiously, though, to avoid blocking of the film.

Adjustment of Guides and Rollers

The ascending tube may wobble from side to side due to extruder surging or rapidly moving air currents in the shop. It is recommended that the tube be supported by horizontal stationary guides at two or three places during its ascent.

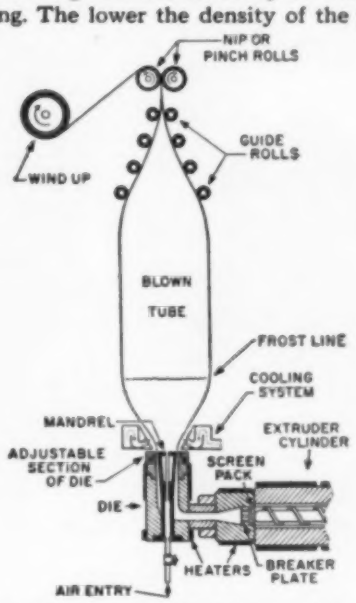
Slight eccentricities in alignment of the nip rolls may be the underlying cause of wrinkles. These rolls must be parallel to insure uniformity of pressure. It is recommended that the rear nip roll be fitted with small hydraulic cylinders to provide positive pressure across the entire width of the nip rolls.

Wrinkling may also occur if the collapsing guides or rollers are not properly aligned with the nip rolls. Many commercial windups contain adjusting knobs for shifting the front to rear position of the collapsing rollers slightly.

Considerations of Gauge, Width, Resin Density

Wrinkling is more prevalent at low gauge and high take-off rates, and precise gauge control becomes even more important. At film gauges below one mil extremely close control of the above factors must be maintained to avoid wrinkles.

Narrow tubing has less tendency to wrinkle than wide tubing. The lower the density of the polyethylene resin used to make the blown tubing, the less susceptible it is to wrinkling because it has more flexibility – will conform more readily to a flat shape.



Technical Help from U.S.I.

As you can see, wrinkling of blown tubing is a problem with many possible causes and solutions. U.S.I. technical service engineers have worked closely with many extruders in tracking down sources of difficulty and suggesting preventive measures. They would be pleased to work with you on this or any other processing problem.

U.S.I. manufactures a variety of film-grade resins meeting the highest and most diverse specifications for clarity, gloss, toughness, stiffness and slip. We would be glad to work with you in determining which PETROTHENE® resin best fits your needs.

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corp.
99 Park Ave., New York 16, N.Y.
Branches in principal cities

DRY CLEANERS' GARMENT BAGS

fastest growing new film market

Polyethylene bags for dry cleaned garments are almost competitive in price with old-style paper bags. The obvious consumer advantages of polyethylene film for garment bags and laundered shirt packaging — "see through" clarity, toughness, reusability — are making this application the extruder's fastest growing new market for polyethylene film.

In making film for the garment bag and laundry market, look for these special advantages of U.S.I. PETROTHENE® 239-27 polyethylene resin:

Better Film Appearance — PETROTHENE 239-27 polyethylene resin gives you films with unusual clarity and gloss at all gauges. Stiffness is also superior.

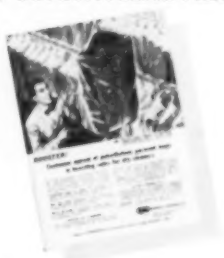
Excellent Drawdown Properties — PETROTHENE 239-27 polyethylene resin gives you up to 30% faster production. Film can be drawn down to as low as 2/10 mil which means better control at thicker gauges.

Wide Resin Choice—You can also choose from a broad line of other PETROTHENE polyethylene resins —select the one that suits exactly the production requirements for the type of film you produce.

WRITE FOR FREE BOOKLET. U.S.I. maintains an extensive research and technical service program to help you with your film extrusion problems. Presently available in booklet form is "Heat Seal Characteristics of Polyethylene Film," a discussion of heat sealing problems of particular interest to polyethylene garment bag makers. For a free copy of this 16-page, illustrated booklet, write to U. S. Industrial Chemicals Co., 99 Park Avenue, New York 16, N. Y.

U.S.I. IS HELPING EXPAND YOUR POLYETHYLENE FILM MARKET WITH ADS LIKE THIS—

The advantages of polyethylene film for garment bags and laundered shirt packaging are being pointed out to the dry cleaning and laundry industries in a series of ads such as the one at right. These ads are designed to pre-sell your potential customers on the sales appeal of polyethylene film packaging. To receive reprints of these ads as they appear, write:



U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corp.
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The lighter side of rubber and plastics . . . colorwise, of course . . . is achieved through the rutile titanium dioxides TITANOX*-RA, TITANOX-RA-50, and TITANOX-RA-NC.

Here's why: these leading white pigments lighten and opacify colors, whiten and opacify white stocks, regulate translucency or opacity, and contribute to durability. In addition, they lighten the burden of processing through ease of dispersion and uniformity of all properties. Our Technical Service Department can help you with any pigmentation problem. Titanium Pigment Corporation, 111 Broadway, New York 6, N. Y.; offices and warehouses in principal cities.

5721

TITANIUM PIGMENT CORPORATION

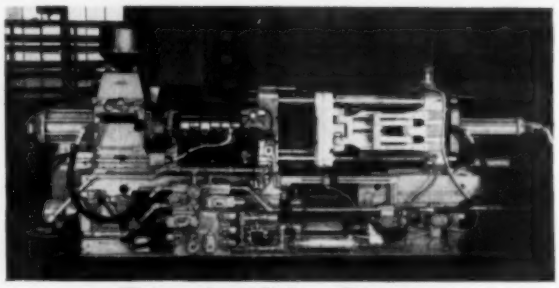
Subsidiary of **NATIONAL LEAD COMPANY**

*TITANOX is a registered trademark for the full line of titanium pigments offered by Titanium Pigment Corporation.

THE LOMBARD LETTER

LOMBARD GOVERNOR CORPORATION

Ashland, Massachusetts, U.S.A.



The Inside Story

Here is a picture of one of the latest Lombard Injection Molding Machines, No. 3220-16, built specially for a leading manufacturer of plastics for the purpose of molding highly complex shapes and patterns. Please note that all covers and guards have been omitted because the picture was taken during the machine's final test stages before delivery.

Lombard is the only machine available with weigh feed as standard equipment — volumetric feed is optional.

We also call your attention to the valves which are all exposed in one manifold for ease of maintenance and handling.

The specifications of this machine called for fully automatic operation, capacity for dealing with a large variety of molds especially those presenting complex coring problems. At the same time, this machine had to be capable of handling materials such as nylon with its fluidity problems and of affording protection to the costly molds against failure to eject the work cleanly when operating unattended and against operator mistakes.

Specifically, it was required that the machine be capable of inserting cores into the mold during many positions of the cycle. It was also necessary, of course, that primary operations could be carried out manually for setting up or clearing the machine in case of operator error or component failure.

A complete treatise on the development of this Lombard Machine and how it operates is available on request.

ENTER THE OVER-SIZED DIE PLATE

Molders are constantly clamoring for faster and more versatile machinery. In 1958, as in the past, Lombard designers are answering that call in many ways. Here at Lombard tremendous strides are being made to push our equipment even further ahead of the industry. Last month brought the release of OVERSIZED PLATENS, a sample of that which is to come in the months ahead.

The maximum die size of a standard Lombard 12/16 oz. machine is from 10% to 55% greater than that of any competitive equipment. These new die plates (optional at slight extra cost) now afford the molder a maximum die size of 23¾" by 36". This is 17% more than currently offered on the standard machine. This item in itself is of great importance. However, when one considers its use in conjunction with the weigh-feeder which is standard equipment and the large die height space available, its value is truly realized.

1. Lombard's automatic compensating weigh feeder permits starve feeding. When starve feeding only three-quarters of a ton to one ton of clamp pressure is required per square inch of projective area. When molding with a cushion (volumetric) two tons per square inch are required. The additional die size provided under Lombard, can, therefore, be utilized. The molder can cut costs on jobs by utilizing the speed of a 12 oz. machine, whereas, were this die space and casting area not available it would be necessary to go to slower and more costly 16 oz. and 20 oz. presses to do a job that can now be done on a Lombrad 12 oz.
2. A maximum die height provided under Lombard is from 8" to 22". Thus even greater flexibility is available for the molder.

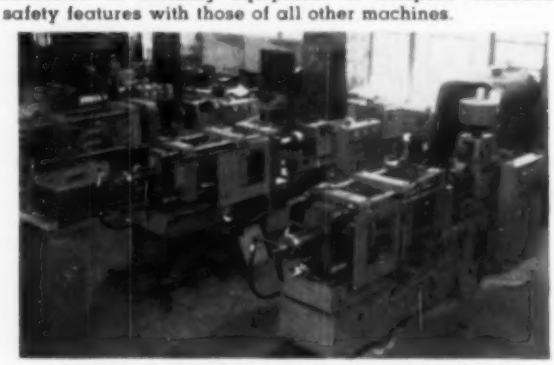
There's Safety in Lombard . . .

In plastic molding, we deal in high temperatures, high pressures and high speeds.

Safety features, therefore, have become an important part in the selection of molding equipment. Without equivocation, we can honestly say that Lombard Injection Molding Machines have more exclusive safety features than any equipment we are aware of being made today. There are four features worthy of special notice:

1. An operator of a Lombard machine is completely protected from each moving part by a carefully conceived safety guard which affords the greatest protection possible.
2. The temperature of the plasticizing cylinder is approximately 800°F. Accidental contact with such high temperatures, no matter how short the duration, can create a a serious injury. A safety shield covers this plasticizing cylinder in such a way that no contact can be made.
3. In the rare cases of electrical or hydraulic failures a mechanical safety bar is incorporated in the integral design of the machine to prevent its operation.
4. Probably one of the most outstanding Lombard developments has been its safety doors which must be closed for machines to operate. Lombard accomplishes this in no less than three different ways, or one may say three methods. It is a triplicate device — if one fails, two others still remain to take over and the machine automatically stops.

You can depend on Lombard's safety features. When purchasing an Injection Molding Machine, this is one of your most important considerations. We urge all those interested in molding equipment to compare Lombard's safety features with those of all other machines.



Injection Molding Machines in final stages of testing at Lombard Governor Corporation, Ashland, Massachusetts

WATCH
for announcement of
NEW
MODEL 2414-6
4/6/8 OUNCE MACHINE
SEND FOR SPECIFICATIONS

REMEMBER THIS:* A LOMBARD INJECTION MOLDING MACHINE WILL DO MORE, *FASTER, BETTER* AND WITH *GREATER SAFETY

LOMBARD GOVERNOR CORPORATION ASHLAND, MASS.

MAY
1958

Plastiatrics

DOW'S CLINICAL APPROACH TO HEALTHY PLASTICS APPLICATION

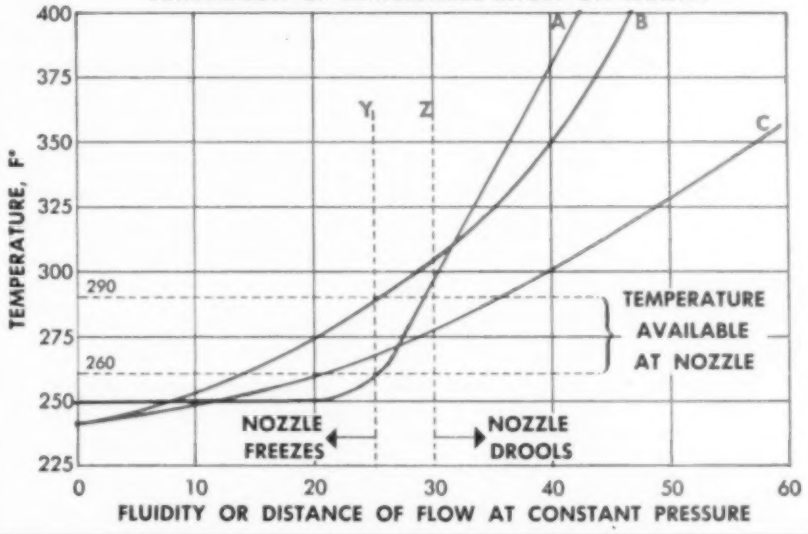
MOLDING CHARACTERISTICS OF POLYETHYLENE AND POLYSTYRENE STUDIED

NEW STUDY AIMED AT REDUCING COMPLEXITY OF MATERIAL SELECTION FOR HOT RUNNER AND RUNNERLESS MOLDING

Careful selection of the materials to be used for hot runner and runnerless molding is extremely important. Both polyethylene and polystyrene exhibit characteristics which are desirable, and various formulations of both materials are widely used for hot runner and runnerless molding. To help plastics fabricators select the right material, Dow Plastics Technical Service Engineers have conducted a series of exhaustive tests on polyethylene and polystyrene and have arrived at the following list of properties which might be desirable for this type of molding:

1. Temperature sensitivity and easy flow at low temperatures.
2. Pressure sensitivity and easy flow at low temperatures.
3. High heat distortion temperature, thus permitting quicker ejection from the mold.
4. A high rate of thermal conductivity to remove the heat rapidly from the material.
5. Low specific heat, thus requiring less time to solidify.

These characteristics are summarized in the chart illustrated at right.



The materials shown, A, B & C, have approximately the same heat distortion temperature. All molding conditions except temperature are held constant. The material in the nozzle must have enough fluidity to flow under the given pressure of 16,000 psi, as indicated by the vertical line Y. A material having fluidity greater than 25 but less than 30 will flow under pressure and will not drool as pressure is released. If the fluidity is greater than 30, drooling will occur.

Material A has a wide softening range and becomes very fluid as the temperature is increased from 245°F. to 255°F. It will neither freeze nor drool at the nozzle or secondary sprue operating at temperatures from 260°F. to 290°F.

Material B is stiff flowing and would freeze in the nozzle until the temperature is increased to above 290°F. The plastic would drool out of the nozzle if the temperature is increased to above 300°F. This is a much narrower temperature range than material A and closer nozzle temperature control would be required.

Material C would also require a narrower nozzle temperature range than material A because it is more temperature sensitive. With the nozzle varying in temperature within the indicated limits, material C could either freeze or drool. The nozzle temperature would have to be very carefully controlled to operate from 270°F. to 275°F. to successfully run material C.

Obviously, material A would be the easiest to run because it has less change in fluidity with small temperature changes.

Plastiatrics studies on this and other phases of plastics formulation, design, molding and finishing continue under the direction of Dow Plastics Technical Service Engineers. For your copy of the paper entitled "Molding Materials for Present and Future Molding Techniques", or for further information on these Plastiatrics studies, write THE DOW CHEMICAL COMPANY, Midland, Mich., Plastics Sales Dept. 1522G.

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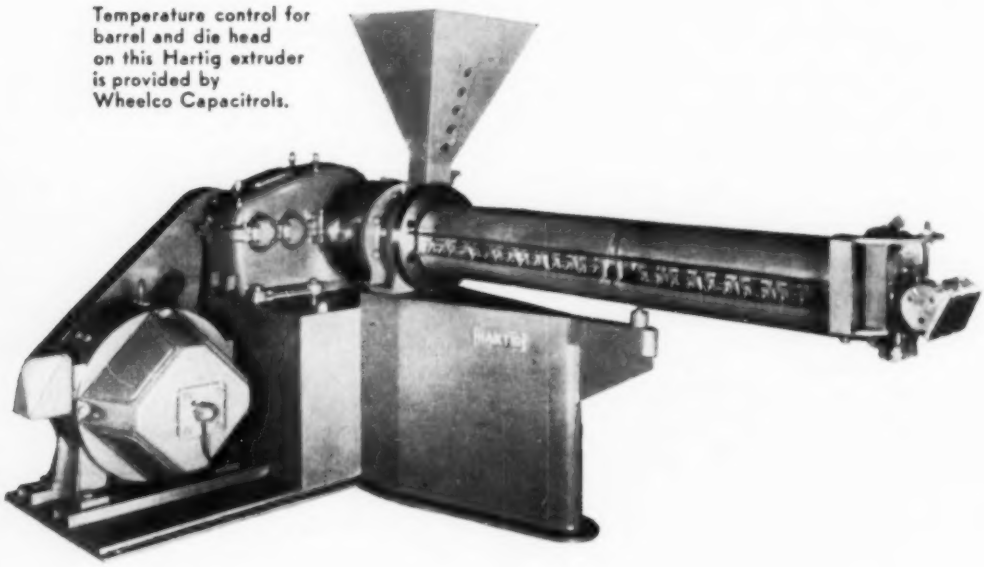
Temperature control for barrel and die head on this Hartig extruder is provided by Wheelco Capacitrols.



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NEWS in BRIEF

"Education for the Plastics Engineer" could be the joint title for two instructive features announced. M.I.T. is offering a two-week session on "The Dwelling House—An Emerging Technology" at Cambridge, Mass., from June 23 to July 3. Rochester Institute of Technology, Rochester, N. Y., is offering its 15th annual program on "Quality Control for the Chemical Industries"; a program that consists of conferences, lectures, and lab periods from June 23-July 2.

Polyurethane foam sales have boomed, according to J. D. Mahoney, Mobay Chemical's sales manager. He envisions a 45-million pound potential for the foams this year. Basic markets for urethane cushioning foams now are in the automotive and home furnishing fields, reflecting the foams' acceptance by industry and consumers.

Radiation facility is available for rental at Midwest Irradiation Center, Rockford, Ill. The unit has an eight-million volt linear accelerator that can produce electron beams, X-rays, or neutrons, as desired, and is available to industrial and academic groups for radiation research.

Business developments in the plastics industry were numerous and varied in nature. National Cylinder Gas Co., Chicago, Ill., revised its corporate structure and changed its name to Chemetron Corp. Emery Industries, Inc., purchased the fatty acid-producing Vopcolene division of Vegetable Oil Products Co. in Los Angeles, Calif. Koppers Co. formed separate divisions for plastics and chemicals & dyestuffs. Krumbhaar Chemicals, Inc., has been purchased by Lawter Chemicals, Inc., Chicago, Ill. Pantasote has signed a license agreement with Italiana Nest-Pak, of Italy, and will manufacture plastics packaging materials using the latter firm's processes and special machinery.

Company expansions in plastics continued apace. An over $1-million expansion project including a new plant and equipment, is scheduled for completion this year by Columbus Plastic Products in Columbus, O. A newly-built injection molding plant was opened in Scranton, Pa., by Consolidated Molded Products Corp. A vertical impregnating oven, designed and built by John Waldron Corp. and Ross Engineering Corp., has been installed at Fabricon Products, Inc., River Rouge, Mich. Foster Grant Co., Inc., went on-stream with its new plant for high-impact polystyrene molding material in Leominster, Mass. Hastings Plastics, Inc., Santa Monica, Calif., opened a new testing lab for customer service. Nicolet Industries, Inc., and its component companies, including Modiglass Fibers, moved to a new building in Florham Park, N. J. Pittsburgh Plate Glass Co. placed in production its new polyester resins plant at Torrance, Calif., adjacent to its paint-producing facility. Texas Eastman plans to expand its polyethylene plant at Longview, Tex. Installation of additional extruders has enabled Tri-Point Plastics, Inc., Albertson, N. Y., to increase its production of Teflon rod by 25%.

New Materials worthy of attention (see pages 477-80): two glass-filled diallyl phthalate molding compounds; very low density, hot-melt type of polyethylene; solid ketone peroxide catalyst for polyesters at room and low temperatures; lubricant for vinyls and polyesters to give mold release and better finish on moldings; paper-base phenolic laminate for electrical uses; 100% reactive silicone resin for electrical insulation applications; single-component epoxy preforms; preflocked, formable styrene sheets; and general-purpose all-acrylic laminating resin syrup.

New Equipment of special interest (see pages 482-4): steel mesh-type scraper-sander; portable plastics pelletizer for extrusions; diisocynate detection kit; injection mold temperature circulator; bench model insulation tester; and portable sprue grinder.

Plastics Applications to be noted (see pages 486-90): molded butyrate fishing lures; molded styrene photo developing tank; polyethylene inner liner for insecticide aerosol spray; extruded, corrugated acrylic sheets; glass-reinforced plastic bathtub; vacuuum-formed panoramic lay-out for model trains; embossed, metallized, perforated polyester sheeting; molded melamine ash trays; Teflon-lined, tapered reducing flanges for pipe and fittings and waterproof electrical switch of molded vinyl.

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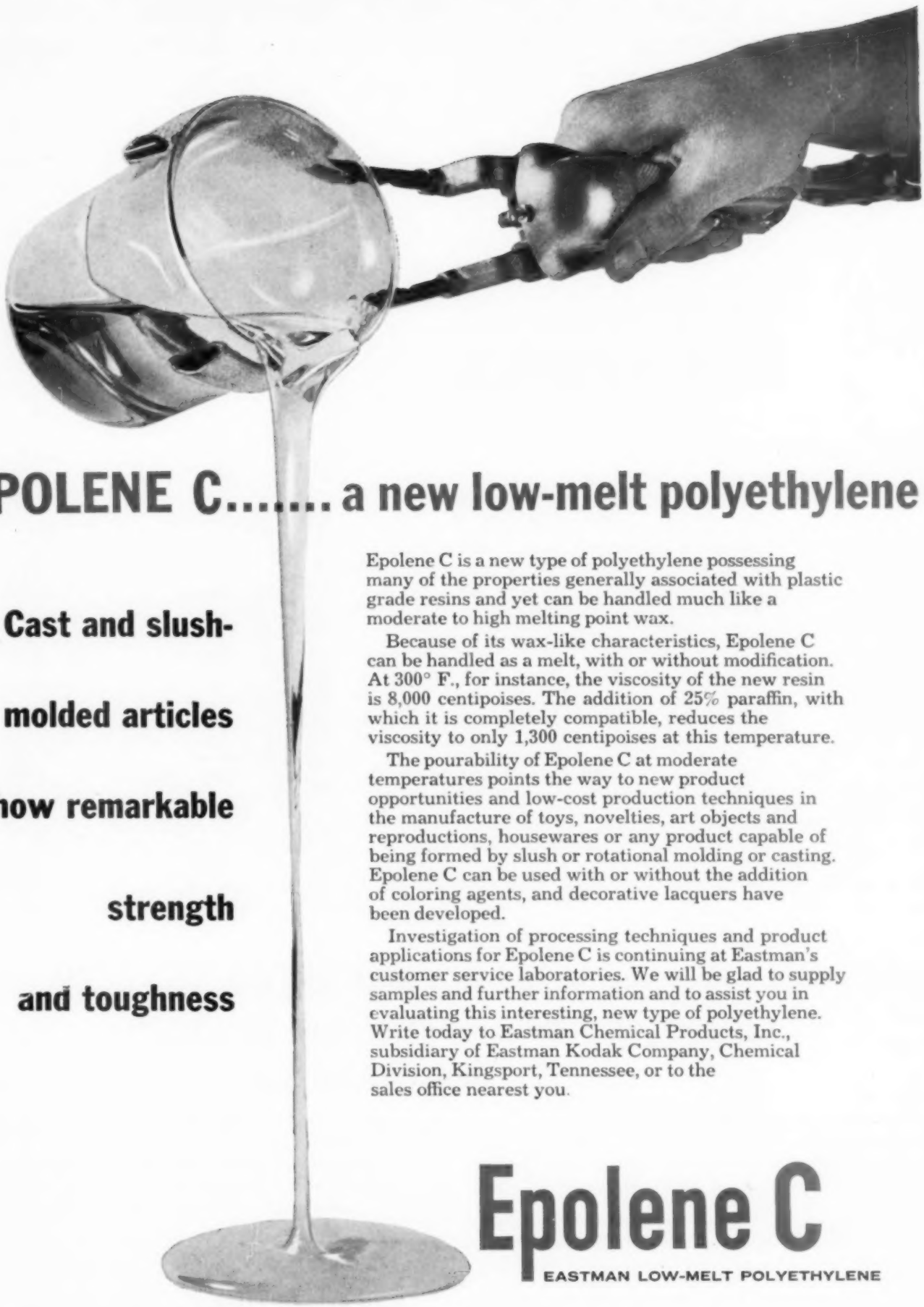

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The pourability of Epolene C at moderate temperatures points the way to new product opportunities and low-cost production techniques in the manufacture of toys, novelties, art objects and reproductions, housewares or any product capable of being formed by slush or rotational molding or casting. Epolene C can be used with or without the addition of coloring agents, and decorative lacquers have been developed.

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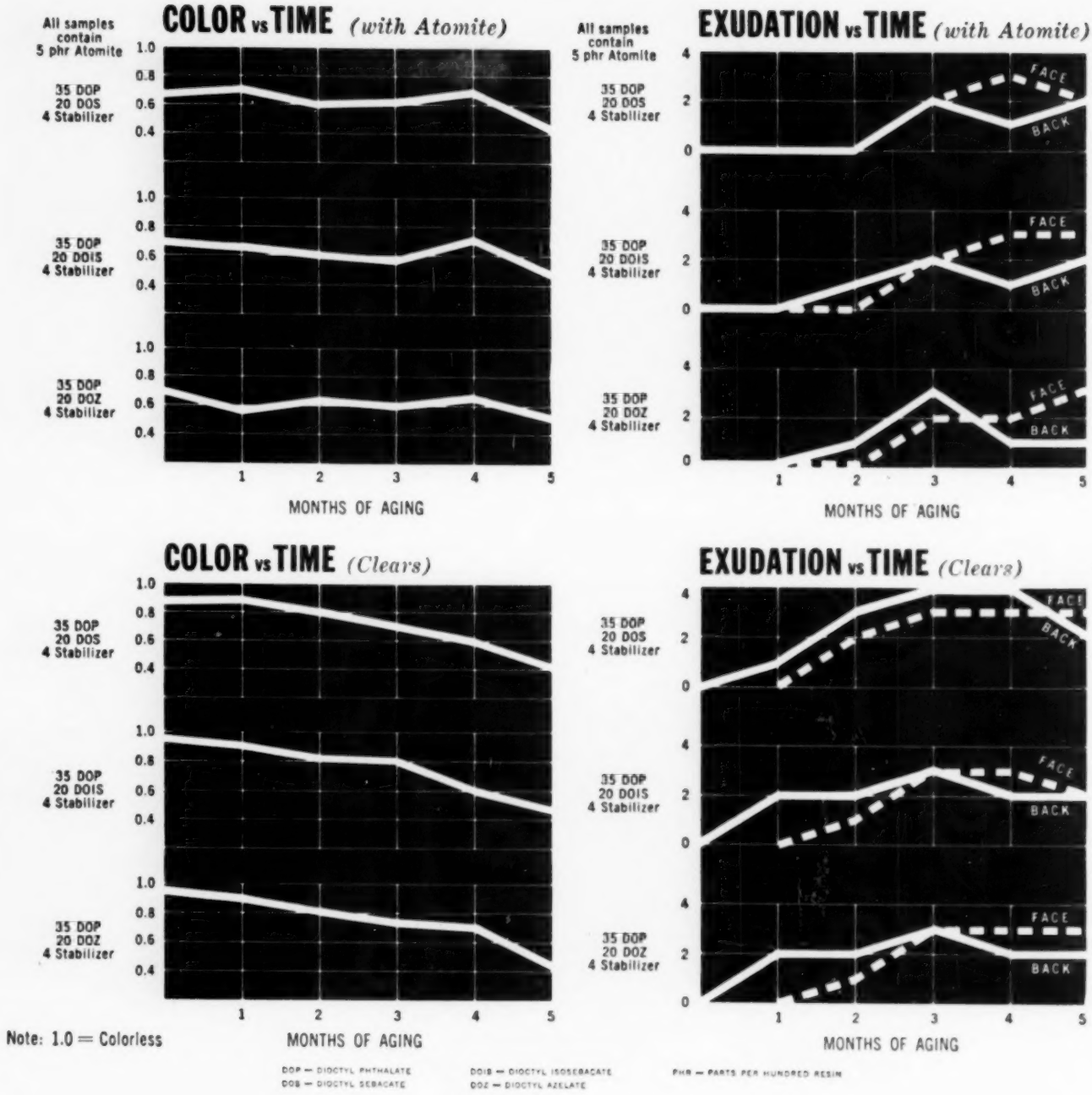

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*Test results supplied through the courtesy of Deecy Products Co., Cambridge, Mass.

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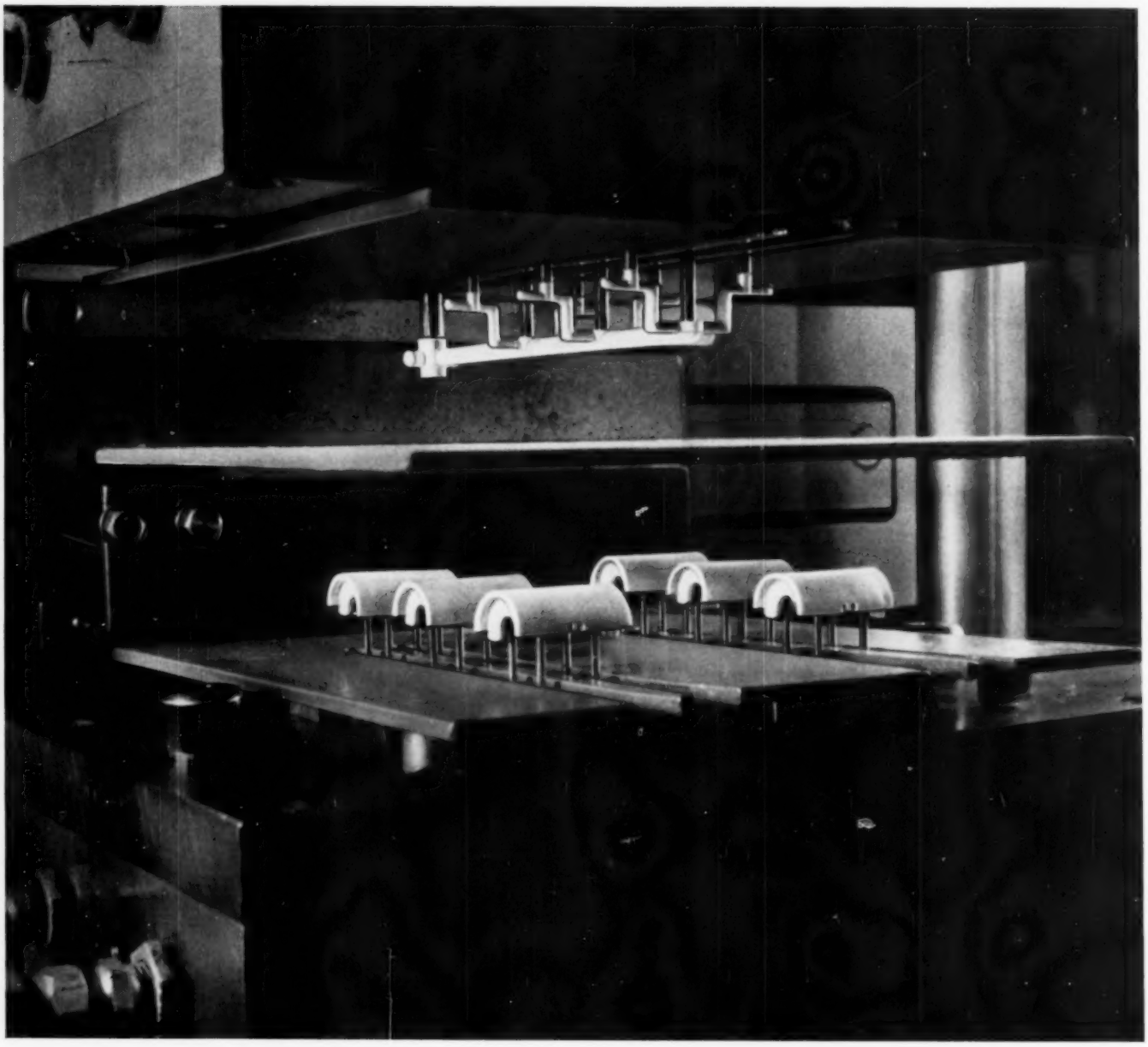

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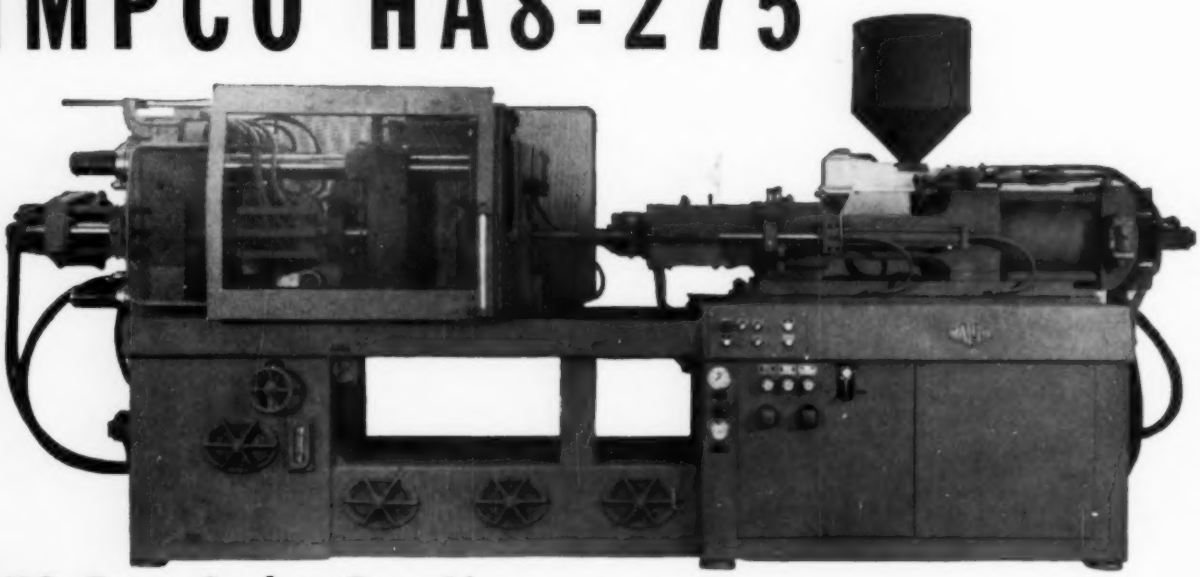

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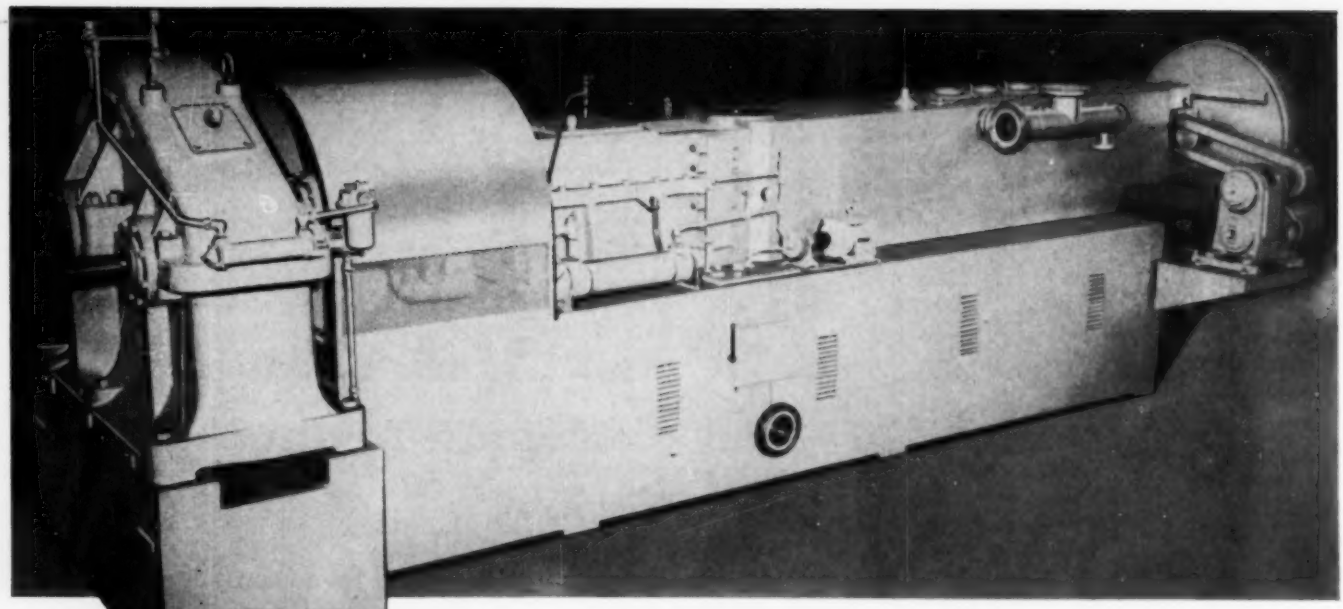

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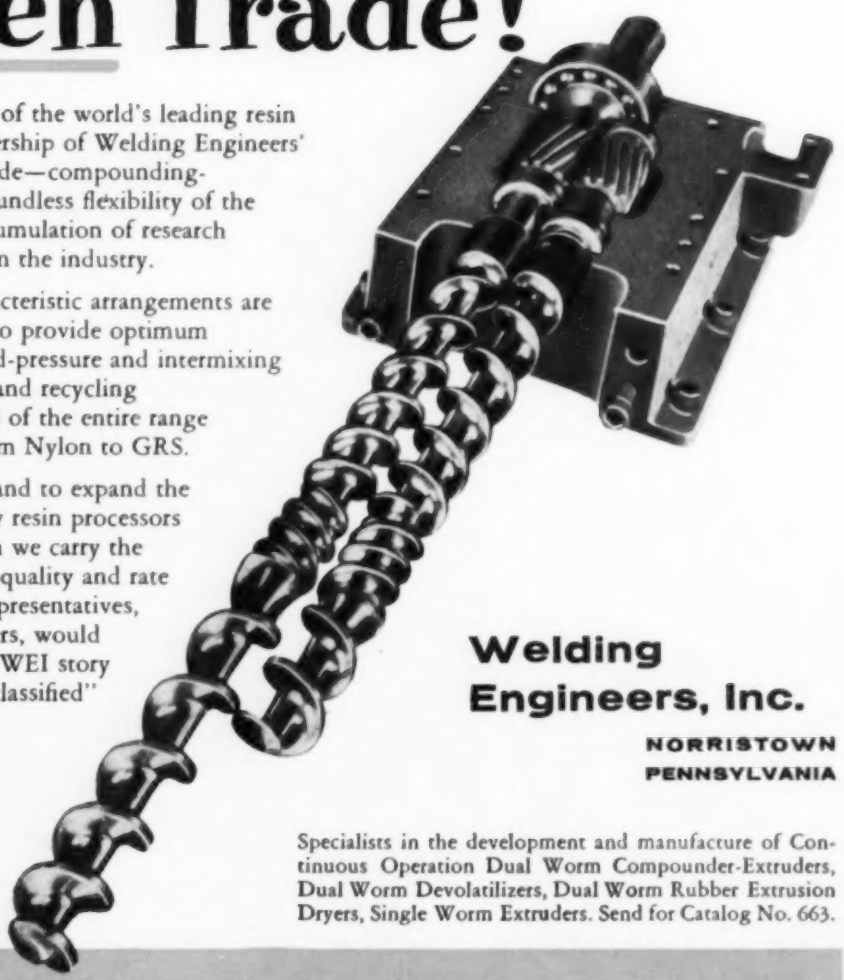

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PLASTICS
TECHNOLOGY

Early Detection of Weathering Damage in Polyethylene

Results are given for a lengthy series of tests to determine weathering damage to polyethylene by three methods of detection.

J. W. TAMBLYN, *Research Associate*
G. C. NEWLAND, *Research Chemist*
and
M. T. WATSON, *Sr. Research Chemist*
Research Laboratories,
Tennessee Eastman Co., Division of
Eastman Kodak Company,
Kingsport, Tenn.

THE growing importance of polyethylene as a thermoplastic is indicated by the fact that sales exceeded a half-billion pounds in 1956 and 1957, and it is estimated that annual consumption will reach a billion pounds by 1960. Consequently, it is of great importance to know what happens to the useful properties of this resin during exposure to outdoor weathering. In particular, if polyethylene is deficient in resistance to weathering, it would be desirable to be able to improve this property by incorporation of suitable additives.

The general impression seems to be that unprotected polyethylene has poor weathering resistance. This impression is apparently based largely on changes in power factor (1)* and low-temperature brittleness (2) of polyethylene as a consequence of weathering exposure. The statement has been made that "the only satisfactory solution to the problem of protecting polyethylene from sunlight is the incorporation of 1-2% finely divided carbon black" (3). Such a verdict would seem to condemn polyethylene to a dark future.

Some progress has been made on the problem of finding a colorless light-stabilizer for polyethylene. For example, Gibbins (4) found that dilauryl 3,3′-thiodipropionate substantially improved the outdoor life of polyethylene. Vincent (5) obtained a patent more recently on the use of 2-benzimidazolethiol for the same purpose.

A program to evaluate weathering stability of polyethylene has been in progress at our company's research

*Numbers in parentheses refer to bibliography at end of article. Based on a paper presented at the SPE National Technical Conference, Detroit, Mich., Jan. 31, 1958.

John W. Tamblyn was born in London, Ont., Canada, in 1910. He attended the University of Western Ontario and Harvard University, and received a Ph.D. in Physical Chemistry in 1938. Following graduation, he joined Eastman Kodak Co. as a research chemist, and transferred to Tennessee Eastman Co. in 1946 (where he now is a research associate). Dr. Tamblyn is an active member of A.C.S., and he, his wife, and two sons make their home in Kingsport, Tenn.

Gordon C. Newland was born in Kingsport, Tenn., in 1927. He attended Eastern Tennessee State College and the University of Dayton, receiving a B.S. in Chemistry in 1950. He joined Tennessee Eastman immediately after receiving his degree, and has been employed as a research chemist since that time. He also is a member of A.C.S. Mr. & Mrs. Newland have one child, and currently reside in Kingsport.

Marshall T. Watson was born in Blacksburg, Va., in 1922. He received a B.S. in Chemistry in 1943 from Virginia Polytechnic Institute, and an M.A. (1948) and Ph.D. (1949) in Physical Chemistry from Princeton University. From 1949-1952, he served as a research chemist with Tennessee Eastman, and was promoted to his present position of senior research chemist in 1952. He is a member of A.C.S., the American Physical Society, and Sigma Xi. Dr. & Mrs. Watson have one child, and live in Kingsport.

laboratories for nearly five years, and results to be discussed here indicate that even unprotected polyethylene stands up sufficiently well after two years' exposure to be suitable for at least some outdoor applications for this length of time. Furthermore, we have found certain nonpigment-type additives which offer promise as weathering stabilizers for this resin.

In order not to wait many years for results of weatherability studies of plastics, ways have been sought to accelerate weatherability evaluation. One such method involves the use of an artificial environment; for example, an Atlas Weather-Ometer in which specimens can be exposed continuously to ultra-violet light. Such artificial weathering machines have been used in evaluating other plastics (6) besides polyethylene (2). Modifications of these machines have been made in an effort to make the results more realistic (2,7).

A second method of accelerating weatherability evaluation is detection of weathering damage after relatively short outdoor exposure times, and before the damage has proceeded to failure of the plastic. This second method is the subject of this paper, and the following three means of early detection of weathering damage will be discussed:

(1). Infra-red absorption measurement of carbonyl groups formed;

(2). Visual observation of crack development in stressed specimens; and

(3). Loss of tensile elongation.

Results will be compared with loss of tensile strength and toughness.

Test Procedure

Except for some of the high-density samples, the polyethylenes tested were all commercial formulations. Compounding with additives was effected by hot-milling on 6 by 12-inch laboratory rolls, internally steam-heated. Compression-molded sheets, 60 mills and ⅛-inch thick, were used for outdoor exposure on the roof of our laboratories. Specimens were mounted on a rack facing south at an angle with the horizontal of 36.5° (the latitude at Kingsport).

Infra-red spectral measurements were made of the adsorption band at 5.81μ, which is due to ketonic carbonyl groups (8). In estimating the ketonic carbonyl content of unexposed samples, the molar extinction coefficient determined by Cross and co-workers (9) was used.

For observing the development of cracks under stress, ⅛-inch specimens were used. Our original procedure used for this purpose paralleled that of the ASTM Proposed Method of Test for Environmental Stress-Cracking of Ethylene Plastics. In this ASTM method, a number of precautions in preparing specimens are recommended. However, these precautions were found to be unnecessary for the less severe cracking conditions outdoors. Thus, for our tests treatment with boiling water, slitting of the specimens with a razor, and the special handling techniques of the test method could be eliminated.

Tensile tests were made on bars die-cut from compression-molded sheets, 60 mils thick, after weathering exposure, using an Instron testing machine at a

Fig. 1. Actinic radiation out doors at Kingsport, Tenn., during 1956.

strain rate of 100% per minute. Tests also were made at the same time on specimens from unexposed sheets which had been stored in a drawer.

Flexural tests were run, using the Tour-Marshall-Olsen Stiffness Tester of ASTM Method D747-50 (13). However, instead of calculating the flexural modulus, as is done in the ASTM test, we calculated a flexural strength as the maximum outer fiber stress corresponding to the highest load-scale reading developed during the test.

The active part of the sunlight was measured by the actinometer, using the uranyl oxalate solution described by Forbes and co-workers (10). By this method, the incident radiation is integrated effectively in the approximate wavelength range of 290-470 μ, within which the damaging portion of sunlight is assumed to lie. Figure 1 is a plot of the actinic radiation outdoors measured by our actinometer at Kingsport, Tenn., by months for 1956, which was a typical, average year. The total actinic radiation was of the order of 50-60 meq. of oxalate. As can be seen, more than twice as much radiation was received from April through October as during the rest of the year. Weathering damage accordingly would be expected to be more severe over these months. Gouza and Bartoe verified this expectation in measuring deflection under load during outdoor weathering of acrylic plastics (11). Because of this difference in severity of exposure at different times of the year, outdoor exposure times reexported herein have been converted to milliequivalents of oxalate decomposed.

Weight-average molecular weights were determined from light-scattering measurements by L. D. Moore, Jr. (12).

Test Results

Table 1 is a summary of observations on low-density polyethylenes without additives. The third column, stress-cracking resistance, is the outdoor exposure time (in milliequivalents of oxalate) required to start cracking in five out of 10 test pieces. The following two columns give the carbonyl content of the unexposed resin and the amount of carbonyl formed during exposure for 131 days (28.3 meq. oxalate) from May to the middle of September. The next two columns give tensile elongation at break, both before and after outdoor exposure from early May of one year to late July of the following year. The last column gives tensile elongation at break, after exposure from May 1955 to October 1957.

It is apparent from the table that, except for the second sample, all the polyethylenes showed about the same amount of carbonyl formation during exposure. This finding was somewhat surprising in view of the fact that the carbonyl content in the unexposed samples varied from no detectable amount for the Tenites to a high value for the last specimen sample. It has been suggested that light absorption by carbonyl groups in polyethylene is "largely responsible" for the photo-oxidation (13). It is entirely possible, of course, that carbonyl groups are present in the unexposed Tenite samples at a concentration below the level of detection of our infra-red test method.

As seen in Table 1, carbonyl formation does not correlate always with other evidences of weathering break-down. The two samples with the greatest stress-cracking resistance showed lower carbonyl formation than the other samples, and the sample that showed highest carbonyl formation had the lowest elongation by far after 14.5 months' exposure. It is obvious from our results, however, that the direct correlation shown between power factor increase and carbonyl formation (14) does not hold between loss of toughness and carbonyl formation. Changes in tensile strength during

Table 1. Outdoor Weathering of Low-Density (Commercial) Polyethylenes Without Additives.

Sample Characterization		Stress-Cracking Resistance upon Exposure, Meq. Oxalate	Carbonyl Content, Arbitrary Units		Tensile Elongation at Break, %		
Melt Index	Mol. Wt. by Light-Scattering		Before Exposure	Formed During 131 Days' Exposure*	Before Exposure	After 14.5 Months' Exposure**	After 29.5 Months' Exposure#
7.1	340,000	26	0.2	61.6	495	40	2
2.1	470,000	24	2.0	95.3	700	20	11
1.7 (Tenite 800)	1,010,000	45	0.0	55.6	800	85	12
0.3 (Tenite 810)	1,160,000	55	0.0	55.4	755	68	10
1.9	1,410,000	25	0.6	58.1	860	68	10
2.1	6,110,000	—	12.2	60.0	755	46	14

* 28.3 Meq.oxalate.
** 69.1 Meq. oxalate.
#130.5 Meq. oxalate.

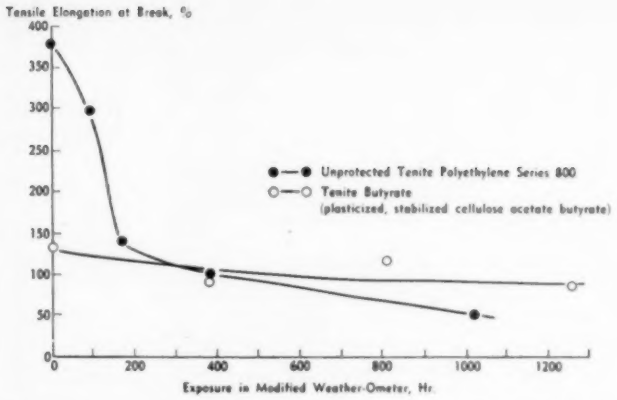

Fig. 2. Comparison of unprotected polyethylene with stabilized butyrate in modified Weather-Ometer.

the first 14.5 months' exposure varied from a gain of 20% for the first sample to a loss of 20% for the Tenite Polyethylenes.

It should be emphasized that for unstressed specimens of all these low-density polyethylenes no appreciable qualitative weathering damage was apparent after 14.5 months' exposure; the specimens showed little or no surface cracking, and still were strong and tough when handled. Thus, the loss of elongation after this length of time, in some cases more than 90% of the original value, should be considered as merely an indication of when practical failure may be expected in the future. We believe, furthermore that these results indicate that unprotected polyethylenes, at least in thick sections, would be satisfactory for many outdoor applications for periods of time in the order of two years. These applications are exclusive of electrical purposes, of course. For applications in which stresses are present, we are inclined to attach more importance to the stress-cracking results as indicative of practical outdoor life. The spread observed in cracking times from the first to the tenth sample was gratifyingly small, in general.

For all the samples in Table 1, however, the last column shows that tensile elongation decreased to a low value after three summers' exposure. For most applications, in fact, the samples would doubtless be unusable after this length of exposure, since there was considerable surface cracking of unstressed specimens. On the other hand, retention of tensile strength was reasonably good; for all the samples shown in the table, tensile strength after 29.5 months' exposure was 40-60% of the original value.

Figure 2 is further confirmation of the expectation of reasonably good weathering stability of polyethylene. In this figure, tensile elongation at break is plotted against exposure time in the Weather-Ometer, modified as described by Tamblyn and Armstrong (7), for unprotected Tenite Polyethylene Formula 800 and for plasticized, stabilized cellulose acetate butyrate. The polyethylene sample was a two-mil-thick film, and the butyrate was a five-mil thick film. Although polyethylene underwent considerable loss of elongation within the first 200 hours, retention of elongation thereafter was reasonably good. After 1,000 hours' exposure, the sample showed no qualitative evidence of break-down; neither did the Tenite Butyrate. Since practical experience has shown that Tenite Butyrate has good outdoor weathering stability for many applications, we believe the same to be true for polyethylene. A word of caution should be given at this point, however: a single property should not be used as the only criterion for weathering break-down. Thus, in a recent report (15), it was concluded that medium soft-flow Tenite Butyrate containing 1% salol was unsuitable for more than a half-year's outdoor use owing to loss of tensile elongation. Practical experience has shown, however, that this composition has a useful outdoor life of five years in many applications.

Figure 3 gives further evidence of the weathering stability of polyethylenes. In this figure, the ratio of the flexural strength of the exposed specimen to that of the unexposed specimen is plotted against outdoor exposure time expressed in milliequivalents of oxalate. As pointed out previously, one year's outdoor exposure is equal to 50-60 meq. of oxalate decomposed. Three different unprotected commercial polyethylenes are represented. The first two entries in the figure were for ⅛-inch thick specimens; the last two were for 50-mil thick specimens. There is an initial increase in flexural strength, followed by a decrease at greater outdoor exposure times. After four years and one month outdoors, however, the two unprotected samples that were run this long retained 50% of their original flexural strengths. Despite cracking on the surface of the specimens, all were bent to the full 90° deflection in the stiffness tester without breaking. We believe these results indicate that polyethylene could be used satisfactorily in at least some outdoor applications for periods of times of the order shown here. One sample was stabilized with 1% resorcinol monosalicylate, and flexural strength still was higher after nearly five summers' exposure than before exposure. Moreover, there was evidence of only very slight surface cracking on this sample after more than five summers outdoors.

Table 2 is a summary of observations on high-density polyethylenes without additives. The rapid deterioration of these samples was not unexpected, in view of the reported rapid embrittlement of linear polyethylenes in air at elevated temperatures (16) and their discoloration in air at room temperature (17). The unexposed samples

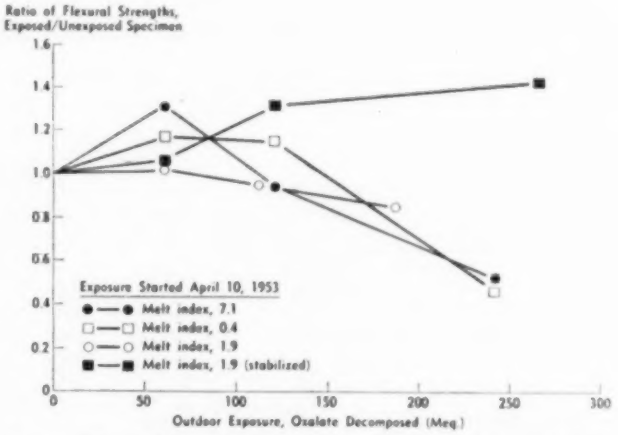

Fig. 3. Effect of out door weathering on flexural strength of commercial polyethylenes.

Table 2. Outdoor Weathering of High-Density Polyethylenes Without Additives.

Density of Sample, G./Ml.	Stress-Cracking Resistance upon Exposure, Meq. Oxalate	Carbonyl Content, Arbitrary Units		Tensile Elongation at Break, %	
		Before Exposure	Formed During 35 Days' Exposure**	Before Exposure	After 53 Days' Exposure#
0.968	11	0.2	0.8	236	4
0.965	13	3.7	12.5	90	1
0.957	5	0.0	8.9	—	—
0.954	33	1.1	10.5	—	—
0.938	50*	8.5	2.8	415	225

* Four of 10 specimens cracked.
**5.8 Meq. oxalate.
#6.5 Meq. oxalate.

Table 3. Outdoor Weathering of Tenite Polyethylene Formula 800 Containing Additives Ineffective as Stabilizers.

Additive*	Stress-Cracking Resistance upon Exposure, Meq. Oxalate	Carbonyl Content, Arbitrary Units		Tensile Elongation at Break, %	
		Before Exposure	Formed During 131 Days' Exposure**	Before Exposure	After 14.5 Months' Exposure#
None	45	0.0	55.6	800	85
Manganous stearate	15	0.0	150.6	680	5
Copper/N,N' -disalicylidene ethylenediamine chelate	24	0.0	45.6	710	21
Copper stearate and p-tert-butylphenol (5:50 mixture)	28	0.6	56.9	750	68

* Total concentration, 1%.
**28.3 Meq. oxalate.
#69.1 Meq. oxalate.

Table 4. Outdoor Weathering of Tenite Polyethylene Formula 800 Containing Additives Effective as Stabilizers.

Additive*	Stress-Cracking Resistance upon Exposure, Meq. Oxalate	Carbonyl Content, Arbitrary Units			Tensile Elongation at Break, %		
		Amt. Before Exposure	Amt. Formed During 131 Days' Exposure[c]	29.5 Months' Exposure[d]	Before Exposure	After 14.5 Months' Exposure[e]	29.5 Months' Exposure[d]
None	45	0.0	55.6	—	800	85	12
Dilauryl 3,3' -thiodipropionate**	72	0.0	28.0	Opaque	700	88	8
2,4-Dihydroxybenzophenone	71	0.0	5.8	"	600	370	4
2-Hydroxy-4-methoxybenzophenone	121	0.0	6.8	"	660	470	1
5-Benzylidene-3-hexadecyl-2-phenylimino-4-thiazolidone	128	15.8	4.2	22.3	690	780	200
Resorcinol monosalicylate	68	0.0	4.7	—	515	525[f]	—

* Total concentration, 1%
**Total concentration, 0.5 %
(c) 28.3 Meq. oxalate.
(d) 130.5 Meq. oxalate.
(e) 69.1 Meq. oxalate.
(f) After 370 days outdoors = 55.4 meq. oxalate.

showed a wide variation in carbonyl content, as did the low-density polyethylenes (Table 1). There was considerable variation in carbonyl formation during exposure, and this measurement failed to correlate very well with other evidences of degradation. Thus, as seen in the table, the first sample showed outstanding resistance to carbonyl formation, but only fair stress-cracking resistance. Of the two samples with the greatest stress-cracking resistance, one showed high and the other low carbonyl formation. The specimens used for these stress-cracking measurements were only 48 mils thick in order to make the surface stress comparable to that used in the low-density samples. The first and second samples underwent almost complete loss of tensile elongation in nearly two months, despite the fact that they differed widely in resistance to carbonyl formation. The last sample in the table can hardly be classed as a "high-density" polyethylene; its density of 0.938 places it near the top density limit of the "medium-density" range (18). However, it had much better stress-cracking resistance and retention of tensile elongation than the other samples.

Table 3 shows results of weathering on Tenite Polyethylene Formula 800 containing 1% of various additives that were ineffective as stabilizers. The first additive obviously accelerated breakdown; it accelerated stress-cracking, greatly increased carbonyl formation, and caused a serious loss of tensile properties. The next additive, a copper chelate compound, reduced carbonyl formation somewhat, as claimed in a patent (19), but actually accelerated stress-cracking and loss of elongation. On the other hand, a mixture of copper stearate and p-tert-butylphenol had little effect on carbonyl formation or tensile properties, but accelerated the stress-cracking. These results again emphasize the danger of relying on a single change (especially carbonyl formation) to predict over-all weathering damage.

Table 4 shows results of weathering on Tenite Polyethylene Formula 800 containing 1% of various additives effective as stabilizers. It should be noted that these are typical examples, chosen from results on a number of stabilizers in order to indicate the ranges of protection that can be achieved, rather than to emphasize any single stabilizer. The first additive, used at only 0.5% concentration, suppressed carbonyl formation slightly and increased stress-cracking resistance, but was ineffective in preventing loss of elongation at either 14.5 or 29.5 months' exposure. The substituted thizolidone, on the other hand, showed outstanding ability to suppress all three types of weathering damage. As of late January 1958, none of the 10 specimens of this formation had reached the stress-cracking point. Since exposure was started in May 1955, this represents more than three summers' exposure. Carbonyl formation was low, even after 29.5 months outdoors. Retention of tensile properties was excellent; after the first 14.5 months, there was no loss of tensile strength or elongation. Even after 29.5 months, this sample had an elongation of 200%, and the tensile strength still was three-fourths of the original value. Moreover, the unstressed specimens of this composition have shown no qualitative evidence of weathering damage to date; surfaces still are smooth, with no cracks or checking. We predict, therefore, excellent outdoor service for this formulation.

The two substituted benzophenones suppressed weathering damage for the first 14.5 months, but failed to prevent loss of elongation after 29.5 months. Despite almost complete loss of elongation after this exposure, however, the first of these additive-containing compounds still retained more than 80% of its original tensile strength. The other composition, however, was badly degraded, since tensile strength had decreased to less than one-third of the original value. It would appear, therefore, that these substituted benzophenones effectively suppress outdoor weathering damage for some time more than 14.5 months and less than 29.5 months (perhaps because they are lost by oxidation). Stress-cracking resistance of the first of these two compositions was only slightly more than 14.5 months.

The first three stabilized compositions in the table were opaque to 5.81μ infra-red radiation after 29.5 months' exposure. The high carbonyl value of the unexposed thiazolidone-containing composition is evidence of the fact that the carbonyl group of the thiazolidone ring absorbs radiation at about 5.81μ. The carbonyl group of the benzophenones, on the other hand, absorbs at higher wavelengths (20) and, hence, does not show up in our carbonyl measurements.

The last composition in Table 4 showed superior flexural strength retention (see Figure 3). In view of the results in Figure 3, it is somewhat surprising that this composition had no better stress-cracking resistance than the first two stabilized compositions shown in the table. Other weathering tests are not complete on his composition, but it showed low carbonyl formation and no loss of elongation after one year's exposure.

Summary and Conclusions

Three methods of detecting early weathering damage in polyethylene have been discussed: formation of ketonic carbonyl groups; development of cracks in stressed specimens; and lost of tensile elongation. In unprotected polyethylenes, carbonyl formation during outdoor weathering did not always correlate very well with stress-cracking resistance or loss of elongation. Caution is indicated, therefore, in using carbonyl formation as the only measure of weathering breakdown. Despite its reputation for poor weathering stability, unprotected polyethylene in thick sections was shown to retain sufficient toughness and tensile properties after two years' outdoor exposure so as to be considered suitable for at least some outdoor applications.

For polyethylene containing additives, carbonyl formation correlated well with the other two measures of break-down only with the best stabilizer (5-benzylidene-3-hexadecyl-2-phenylimino-4-thiazolidone). This stabilizer showed excellent ability to suppress all three types of weathering damage. A composition containing 1% of this thiazolidone had good tensile properties after three summers' outdoor exposure and, consequently, should give good outdoor service.

Several other stabilizers suppressed all three types of

(*Continued on page 455*)

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End-Use Correlation of Styrene Container Testing

Some field-performance conditions for styrene containers and coffee cups can be correlated with laboratory tests, but further work on this subject is required.

THIS article is confined to our study of container applications for general-purpose and rubber-modified, 7¼-ounce, styrene coffee cups. These containers were made by injection molding. Sheet-formed containers and cups were not utilized because there are, at the present time, no commercial-volume manufacturers of these types, and the processes involved are still under development.

Within the past several years, the plastics packaging industry, and particularly that segment which utilizes styrene, has grown to maturity and has fully accepted its responsibility as a participant in a dynamic consumer economy

Where styrene containers were used initially as stock containers for the ice cream or cold package market, many different types of foods are packaged and stored today in styrene containers for mass-marketing purposes. Where styrene previously had no utility at all in the hot-drink cup market solely because of economic factors, it now has established a foothold in this market because of techniques enabling it to be molded and sold competitively on its own merits.

The introduction of styrene stock-food containers and 7¼-ounce coffee cups brought with it the prerequisite that characteristics of the items be acceptable in all stages of production, shipment, packaging, storing, and merchandising. As with any new application, the rate of the new market's expanding acceptance will determine how these problems will be faced and met. It is apparent in the sales expansion that the majority of the problems will be solved successfully to the satisfaction of the food packager, molder, and consumer.

The studies upon which this paper is based deal with continuing aspects of quality in critical areas, and the need for a suitable test program. Realizing there would be an expansion of applications for these packages, it became necessary to correlate field problems with container characteristics. If the container could be improved or even pre-tested statistically before shipment, end-use problems would be minimized.

Based on a paper presented at the National Technical Conference, Society of Plastics Engineers, Inc., Detroit, Mich., Jan. 29, 1958.

One of the phases of our laboratory work was an attempt to pick up those fine differences that possibly could result in field deficiencies. We also have attempted to relate these to packaging problems involving specific foods. We believe that the areas chosen, correlate with some of the more vexing problems confronting acceptance of styrene packages in the market place.

Let us treat separately the one-pint container and the thin-wall impact-styrene drinking up.

One-pint Containers

The first one-pint, general-purpose styrene containers were of heavy wall section (0.050-0.060-inch thick) and so of substantial strength. These containers essentially were of "re-use" type, with the thick walls providing more than adequate resistance against abuse and breakage during actual usage. The advent of thinner walled styrene containers (as thin as 0.035-inch wall) to meet market economic acceptance on a mass volume-distribution basis resulted in several different types of problems.

Table 1 relates some possible manufacturing problems with potential marketing deficiencies.

Table 1. Product and Market Deficiencies of Plastic Packages.

Product Deficiency	Market Deficiency
1. Weak Bottom from Strain, caused by packaging of the material during molding.	1. Cracking up on freezing or upon handling of loaded container.
2. Weld on wall side at top rim, caused by a core shift.	2. Snapping-off during handling at the packager or service area.
3. Lip fracture caused by strain ejection, or dropping (with styrene); Lid too tight because of excessive shrinkage (with styrene or polyethylene).	3. Lid pulled off during packaging or subsequent handling.

Let us consider how each one of these product deficiencies could possibly be ascertained by prior testing to prevent subsequent resentment over a package deficiency in service.

Weak Bottom

During the injection molding process, packing of the styrene may occur at the gate area of the center-gated container bottom. Packing, which normally can occur from too much material feed, too long an injection dwell, or too high a pressure, can produce stresses in this critical area of the molded container. It is here that the full weight of the packaged ingredient rests, and where it is dropped when placed in the cold cabinet. Even "stringing" (pulling out of styrene from the nozzle) at the gate during molding can produce stresses due to the high-tensile pull as the container is ejected.

To ascertain a level of performance adequate for field usage, (1). several conditions are determined by holding cycle adjustments where one condition under

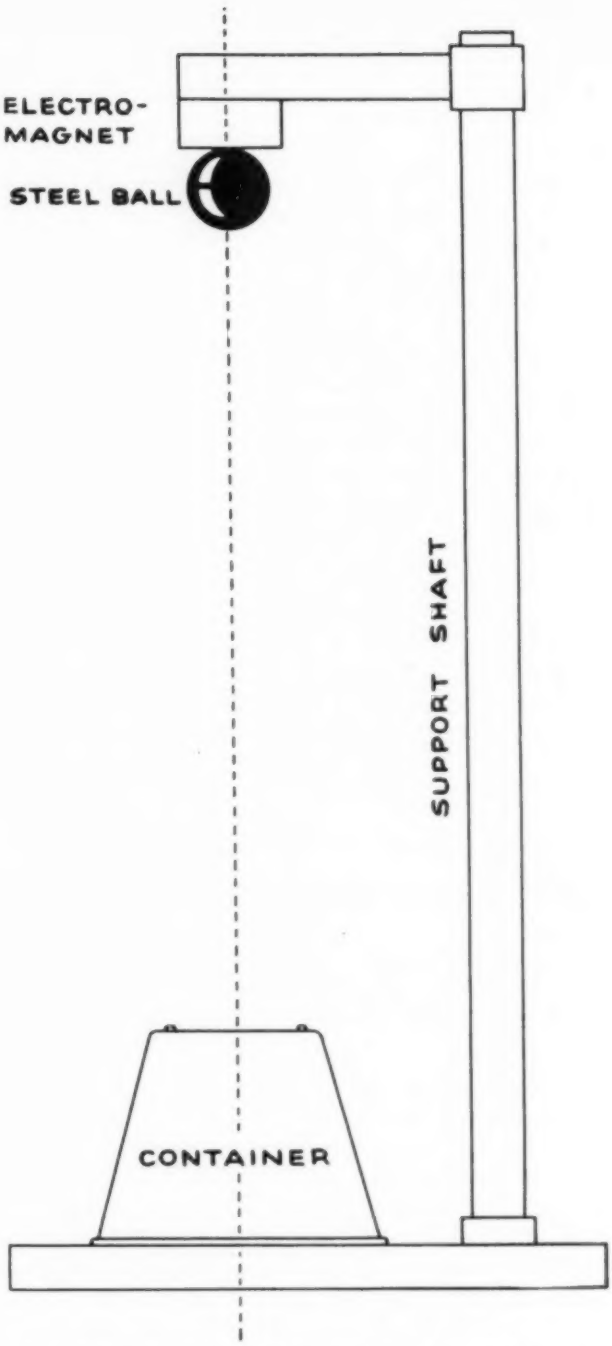


Fig. 1. Schematic drawing of free-falling ball-drop impact test for thin-wall plastic containers.

crossed polaroids shows up minimum welds; and (2). these containers are tested as described below with an arbitrary level of performance established as a criterion for eventual reference.

The test consists of the ball drop technique (see Figure 1). An electro-magnet is used to hold a ball of specific weight that is set to release at a specific height where testing is initiated. The electro-magnet is turned on to hold the ball, and turned off to release the ball. We record whether or not the container breaks on impact. Arbitrarily, a ¼-inch crack in the container wall is considered a break and, from this,

the strength level of the container bottom is ascertained.

This method measures impact resistance, and is an attempt to correlate with possible sharp blows during handling that could fracture the bottom. It is adequate for comparing resistances to shock impacts of the containers under these conditions. As such, it may be used to differentiate among resins of different strength levels, and should be useful in correlating container strengths at various wall sections.

An alternate method of testing would be to utilize different ball weights and establish which weight at the same height fractures the container. This would utilize ball weights at which 50% of the samples fail; these are referred to statistically as the mean-break strengths. These can be converted into terms of energy absorbed on impact by multiplying ball weight by the height at which it is dropped. For screening purposes, we feel that the specific weight ball dropped from varying heights is sufficiently fast and adequate for the results desired.

This test can be used to determine at what processing point in the molding operation does some variable go out of control, and bottoms become weaker. It should be realized, however, that considerable data must be accumulated before significance can be attached to the results obtained. At least 2-3 dozen containers should be tested when using the ball drop technique. Typical figures (average) for ball drop test on a specific 16-ounce container bottom are shown in Table 2.

Table 2. Ball Drop Test Results on a 16-Ounce Container Bottom.

Cavity	Ball Drop (5½ gram ball) Distance, in feet, to crack container bottoms 50% of the time
1	1.0
2	1.1
3	1.3
4	1.3
5	1.1
6	1.5*

*Cavity 6 has a significantly higher rating of strength than Cavities 1, 2, and 5. Thus, these latter cavities would bear further investigation from the point of view that the containers have weak bottoms and are highly stressed.

Stressed Sides

A source of weakness in molded containers is due to plastic setting up or hardening rapidly on the cavity wall surfaces, thus not allowing for sufficient flow of the material through the center section between these hardened or "skin" surfaces. High pressures are required to obtain complete fill of cavity. This effect of inadequate flow into the cavity creates weakness in one direction, which is known as orientation. The orientation effect is the one which is most difficult to minimize, but certainly is one of which we should be aware.

For the purposes of this discussion, the term "thin-wall" encompasses all wall sections below 0.030-inch in thickness. Below this wall section, the orientation effect is more severe. Frequently, either the core shift or welds cause poor side-wall strengths, and these result in poor-quality containers that often split along the sides in the cold box because of too high a strain from the packaged ingredients, or when hit accidently by another container during handling. In testing for this deficiency, either a ball drop or a compression test can simulate this effect.

Two conditions of end-usage and package handling are reproduced with the ball-drop test:

(1). Filled Containers: To simulate conditions where the container is loaded with the ingredient, a mandrel is employed and the ball strikes a rigid, inflexible surface, causing rupture.

(2). Unfilled containers: Some containers crack from handling or shipping when empty. Therefore, containers also are tested by ball drop without the mandrel. In effect, the container flexes and absorbs energy before fracture. At 0.030-inch wall thickness or below, flexing or absorption of energy does take place before rupture, and a mandrel should be employed. At the greater wall-thickness section, very little or no flexing occurs, and a mandrel is not required.

An empirical hand test often is employed by the end-user to test the strength of the container. Here, a cup is held in the hand, and the thumb presses inward on the walls. Fracture occurs along the direction of orientation. To simulate this type of flexure (actually a measure of tensile elongation), a test was devised using a compression technique. This test will be described more fully in the article section discussing cup testing.

An Instron testing machine is used. This is a compression-tension instrument that can be adjusted to as fine a measurement as a two-gram force. The container is placed in the anvil and the cross-head moves downward in compression at various speeds (see Figure 2). Known acceptable containers were used to establish initial criteria of performance. Breakage, or tensile weakness, then was determined.

Lip Strain

An essential part of package design is the lid-to-

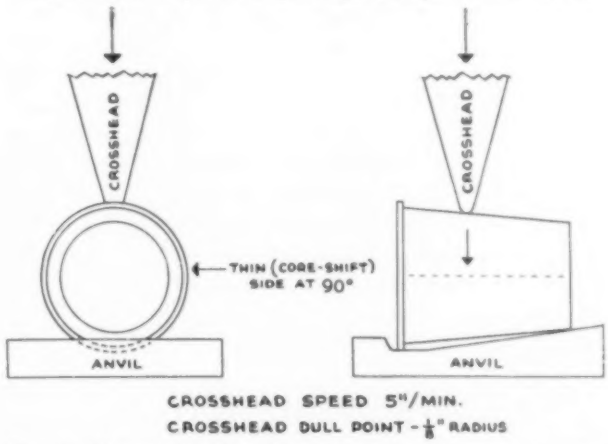


Fig. 2. Flexure test for thin-wall plastic coffee cups, using Instron Tensile Tester with compression cell.

container fit. If the lip is highly strained or not filleted sufficiently, possible fracture at this junction of the wall and lip may occur. Frequently, when polyethylene lids are used, shrinkage of the lid may be out ot control and either too tight or too loose a fit may result. As a consequence of excessive tightness, the lid may produce shearing forces inward that actually shear the lip from the container body. A standard go-no-go container/lid fit should be employed to check periodically the performance of the lid. Unfortunately, new lids must release their shrinkage strains; therefore, it is recommended that they not be tested for several days. The package should be filled with an ingredient, since some force upward on the lid will heighten the shearing effect inward on the lip's beaded area

Strength testing of styrene lids may be undertaken, utilizing the ball-drop impact test previously described. This test has correlated well with field experience. Table 3 indicates a range of results achieved with this test method.

Table 3. Ball Weight (3.53 grams) Results on Lids

Cavity	Wall Thickness, Inches	Ball Drop Height, Inches
1*	0.025	18
2	0.028	30
3	0.027	33
4	0.027	28

*Cavity 1 is considered inadequate for end-use performance. Upon investigation it was found that a higher order of strain was being induced during the molding operation from ejection.

Chemical or Ingredient Attack

Polystyrene has a broad range of resistance to chemical attack. Chemical resistance is improved slightly by the usage of the rubber-modified resins, as compared to the general-purpose types. Certain types of strong acids and alkalis, as well as selected solvents, will attack styrene. Molding conditions also can determine the degree of chemical resistance by the high or low level of molded-in strains in the part.

Complete chemical attack is not necessary to exclude a material used to package ingredients. If only surface attack occurs, the styrene may lose its utility as a see-through container. Also, physical strength properties, such as tensile elongation, can be lowered by chemical attack, especially in highly-stressed containers. As with the polyethylene blow bottle, many styrene containers are used in applications where evident borderline attack occurs and the package, as well as its ingredient, loses its utility. Thus, careful scrutiny of the end-use by the material supplier, molder, and packager is important.

We have found that chemical attack is doubled for every 180° F. increase in temperature above room temperature and, therefore, ambient temperature storage conditions are important to the test definition. We have utilized an air-oven test which correlates with chemical attack under accelerated aging conditions.

A circulating air oven at 160° F. is employed, and molded pieces of polystyrene are immersed (or in actual physical contact) in the ingredient for a period of seven days in the oven. After this period of time, the molded pieces are observed for crazing, cracking, and tensile elongation properties often are tested to determine if any lowering of this property has occurred.

Hair-line crazing (surface etch) or cracking generally will indicate that the ingredient should not be packaged in polystyrene. Sometimes, however, impact styrene can be employed in the application because of the material's higher critical tensile elongations. Where general-purpose styrene would be borderline, high-impact styrene could be satisfactory.

An example of how this test can be useful is illustrated by the following case history. A major packager was using general-purpose, stock, 16-ounce containers for a particular vegetable salad. The beaded rings of the containers were shearing off when the lid was placed in the container after the latter had undergone 24 hours of storage in the chill room at 40° F. The salad was tested under the conditions of the oven-aging procedure, and it was found that it etched the styrene, with the crazing marks being noticeable In relating this fact to the actual end-use problem, it was ascertained that one or more of the ingredients of the salad oil attacked the styrene at a point of weakness in the beaded rim where no fillet was used, so that a high stress concentration was present. Some salad oil was trapped between the beaded rim and the polyethylene lid. Since the polyethylene lid always had a slight tension fit, it placed shearing stress on the beaded rim. This lip, weakened by the attack of the salad oil, smeared off, making the container unusable. Changing of the salad oil ingredients was not possible, but the usage of other type salads without these crazing ingredients allowed the container to be fully utilized.

Moisture Vapor Transmission

An important feature of any packaging material is its utility as a vapor barrier. Thus, the moisture vapor transmission test, is a most important measurement of the usefulness of polystyrene in certain packaging end-use applications.

Specific testing was performed with many different types of package items, such as coffee, bouillion, concentrates, etc. The testing was performed in a moisture-vapor transmission chamber (a closed chamber) at 90% humidity and 100° F. temperature. The passage of moisture during the test period was a measure of the hygroscopicity of the food and/or the effectiveness of the vapor barrier. If the ingredient taste was affected by moisture, the samples always were sent to the packager's customer for final taste analysis.

Since moisture vapor transmission can be related very accurately to thickness of wall section and type of seal at the lid, data is being accumulated on the effectiveness of styrene as a moisture barrier for many different types of foods. While thicker walls in styrene pint containers may enable them to be an improved

moisture barrier, economic competitive conditions demand a thin-wall (a maximum of about 0.040-inch in thickness is allowable for most markets). As yet, we have not found a coating that will inhibit moisture transmission to any significant degree on styrene container walls. This type of coating, if it is found, may well be the panacea to the moisture-vapor transmission problems of styrene

Thin-Wall Cups

During the past several years, considerable molder engineering efforts and most tooling developments on styrene drinking cups have been in the areas of producing parts with thinner walls. The results of the molder's efforts produced a logical development; the thin-wall coffee cup of 0.014-inch wall section. These cups, because of their property attributes of no taste and good design, enabled competition against low cost paper cups. Needless to say, however, some problems were encountered when these cups were first introduced to the market. One of these was cracking on the cup side due directly to movement of the core during molding, so that one side of the cup became thinner than the other

Drinking cups may be subjected to flexural stress when held between the thumb and forefinger of the hand. When this flexure (actually tensile elongation) proceeds beyond the material's and part's capabilities, fracture or splitting parallel to the oriented direction results. If any core shift occurred in a cup 0.014-inch it would be severe indeed on a percentage basis. For instance, a 0.002-inch core shift in a 0.040-inch thick cup is only 5%, but the same core shift in a 0.014 -inch thick wall cup is 14% so that the consequence is much greater. It was felt that any core shift would be undesirable, but it was admitted that some certainly would result. The problem was to locate the point in time at which the shift started to become serious enough to warrant correcting during manufacture .

Tensile Fracture Test

It was felt that a true measure of this tensile fracture problem would be a mechanical simulation of this technique. A test was developed by our company's Research Laboratories which we believe simulates the effect of pushing in the cup side-walls by pressure of the thumb and forefinger.

The machine used is an Instron Tensile Tester, and the test method employs a compression cell strain gage, instead of a tensile cell. The cup is placed in a stationary anvil (see Figure 2), and the cross-head moves down at a specific rate of speed until fracture occurs The thinnest wall (i.e. that of the greatest core shift) is placed horizontally or parallel to the machine base. The point at which fracture occurs is noted on a load-deformation chart (see Figure 3) that is driven at a constant rate.

We were able to pick up a difference between cavities, and between various materials used. This was indicative that each material had its own moldability capabilities (i.e., pressure-temperature relationship) and, of course, physical property levels.

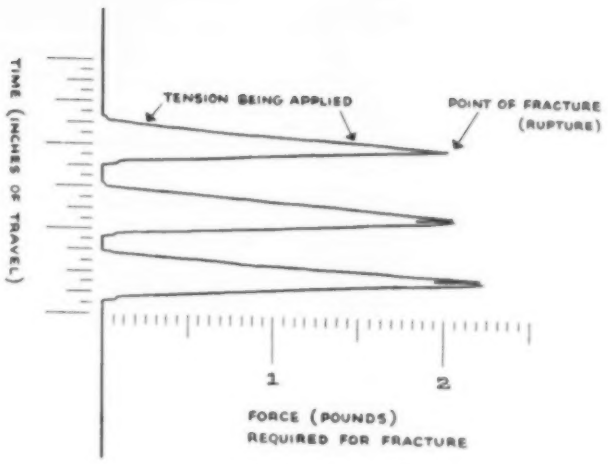


Fig. 3. Typical chart obtained in flexure test of thin-wall coffee cup. Pen attached to strain gage traces force application vs. cross-head travel.

An interesting fact was that all cups showed a weld phenomena at the point of greatest core shift; this is where the fractures first appeared on flexure, but were not noticeable visually until strain was placed on the cup during the testing procedure. Some data from this run is shown in Table 3.

In analysis of these results the following points are of interest:

(1). Failure actually occurred at the thin side of each cup (where a weld was present). Consequently, this test actually measured the strength of this flaw for each cup, rather than the actual strength properties inherent in materials. The strength of this flaw, however, could be related to the relative tendency of the material to effect a strong weld. If there was no core shift, this test could be a true measure of part design strength, but we have not encountered thus far any cups that are constant in wall section through 360° of arc. Inherently, the injection molding process tends toward shifting the core.

(2). The stress required to reach critical deflection of the cups is dependent on some exponential factor of the thickness of the sides. This also is complicated by the core shape of the cup.

We do not feel that these test methods are the ultimate criteria of end-use performance. Field performance is a most difficult condition with which to correlate. Different techniques of handling from one package to another, different storage conditions, and, in particular, different container designs leave many questions that still remain to be answered.

For example, we have found that apparent "toughness" of a container sometimes can be a difficult thing to define. Illustrative of this would be to take a thin-walled drinking cup and design it with four different lip designs (see Figure 4). Cup "A" offers the least resistance to inward flexing, and Cup "D" the maximum. This measurement, of course, would be a criterion of "stiffness" or rigidity, but Cup "A" appears subjectively to be much tougher. The cups from "A" to "D" illustrate degrees of rigidity, and progressively offer more resistance to inward flexing. This illustrates

one of the problems of correlating small differences in cup and container design and, of course, in wall section, with ultimate end-use performance.

Table 4. Flexure Strength Measurements of Thin-Wall Coffee Cups.

Cavity	Strength, Pounds	
	Individual Cups	Average
1	2.43	2.18
	2.20	
	2.02	
	2.25	
	2.02	
2	1.90	1.81
	1.69	
	1.80	
	1.76	
	1.92	
1	2.50	2.46
	2.37	
	2.39	
	2.52	
	2.54	
2	2.16	2.01
	2.15	
	1.80	
	2.06	
	1.90	
1	1.84	1.86
	1.81	
	1.94	
	1.85	
	1.87	
2	1.70	1.78
	1.79	
	1.78	
	1.82	
	1.83	
1	2.25	2.44
	2.30	
	2.55	
	2.34	
	2.75	
2	2.20	2.22
	2.27	
	2.41	
	1.95	
	2.26	
1	2.16	2.23
	2.04	
	2.41	
	2.50	
	2.03	

Future Outlook

It is believed that we have demonstrated that it is possible to correlate some field performance conditions with laboratory testing when utilizing styrene containers. However, there are many areas where test correlation can be improved and new tests developed.

The growth of styrene in the packaging market is such that end-use performance must be considered more carefully. The development of tests to screen-out improper applications should be considered a necessary function of the material supplier, the molder, and the packager.

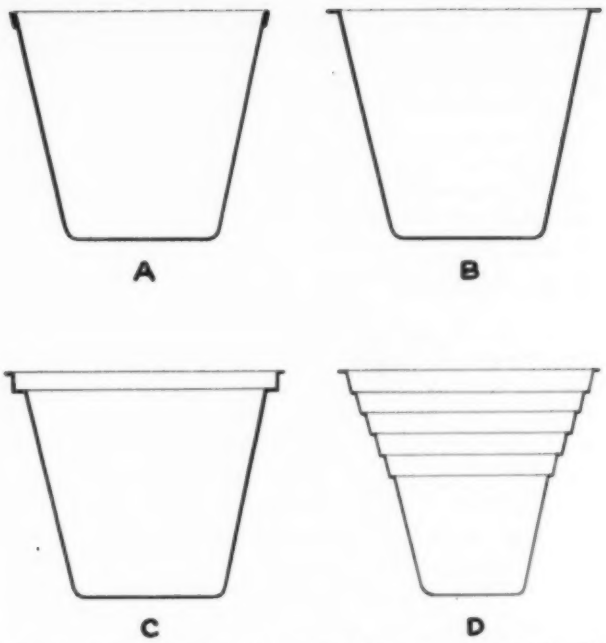


Fig. 4. Four designs for thin-wall coffee cups of constant wall thickness showing progressive resistance to inward flexing.

Lab worker faces 2,200° F. in comfort.

High Temperature Visor-Mask

Research and other personnel who must observe molten materials no longer need risk burns and discomfort, thanks to a recent development by New York Air Brake Co.'s Vacuum Equipment division. The firm has developed a coating which, when vacuum deposited on a plastic mask, effectively reflects 95% of the infra-red rays without affecting vision. This means that the worker can face radiant heat above 2,000° F., while temperature between visor and face remains at 80° F.

Material used for the mask is CR-39, Pittsburgh Plate Glass' specialty polyester resin, which features both optical clarity and high temperature resistance. NYAB can deposit their coating on any plastic with a low vapor pressure; i.e., some acrylics, styrenes, and PVCs.

GORDON B. THAYER, *Plastics Specialist*
Plastics Technical Service
Dow Chemical Co., Midland, Mich.

What a Plastics Engineer Should Look For When Planning to Buy An Injection Molding Machine

PLANNING the purchase of injection molding equipment is extremely important. The planning should be made as far in advance as possible, and someone should have responsibility for the entire planning operation. It is reasonable to place this responsibility in the engineering department, but there is need to consider all aspects of the purchase and, therefore, all departments should be consulted and urged to contribute their ideas. Several major areas of planning may be listed. Some of these are beyond the scope of the engineering department, but the factors involved often are more important than the engineering considerations.

Proposed Use

The immediate and future needs for the next five years must be considered carefully. The general management and the sales department will have a great deal to say about the kind of work that the machine will be expected to perform in the molding plant. It is suggested that a survey of jobs that have been done in the plant should be made; and the sales department should be asked to write out some predictions of the needs of the plant during the coming years.

The machine under consideration may be a special or a universal machine. If automatic, high-volume production is desired, a specialized machine may well be the kind that should be purchased. For custom molding and short runs, a universal-type or standard model is likely to be considerably less costly for the initial purchase. One question which should be considered very carefully is how long the machine will remain competitive in the industry. This requires careful engineering evaluation of the machine specifications and of the tasks that it is likely to be required to perform.

The question of the type of heating and injection means often is subject to debate. Conventional or single-ram injection machines have been considered to be the thing to buy in sizes up to 16 ounces while preplasticizing-type machines have been considered desirable only for the larger size machines. However, preplasticizing has been employed on machines as small as four ounces

in rated capacity, and the results have been good. Preplasticizing offers many advantages besides large size shots.

The problem of what to do with the machine that is to be replaced by the new one generally is left until last. Sometimes the salvage value of the metal in the machine is worth more to the molding plant in the long run than a trade-in allowance. If a machine is obsolete, it certainly should not be kept in the molding plant. If it is obsolete in one plant, it is likely to be obsolete anywhere else it is used.

Principal Specifications

Builders of injection molding machines publish a list of specifications which may be called the principal specifications of the molding machine. There are many other specifications that usually are not published in the sales and warranty literature of the manufacturer. The principal specifications will vary in their degree of importance to a given molding plant. The proposed use of the machine will have a great deal to do with the order of importance of the specifications. It will be necessary for the planner to arrange the principal specifications in the proper order, and provide some system of attributing the proper weight to each of the items. A molding equipment salesman will consider this list in his own order of importance because of various competitive advantages that he feels he has. However, this is not the order of importance to the buyer.

It is well to examine the specifications, prints, and descriptive information for modern design features. Convenient location of the power plant for the molding machine is extremely important. Sometimes it may be placed where it is most convenient for the user, regardless of the standard location of the plant on the machine, as shown in the catalog. Another feature of modern design which has been discussed at great length is the provision for multiple nozzles. If there is a need for them, they should be specified on the machine, but if there is no foreseeable need, their added cost is not necessary.

The heating cylinder specifications are extremely important. Standard ratings of plasticizing capacity have been established. These standard ratings, however, cannot apply to all molds. Each mold has different moldability demands and, therefore, the plasticizing rating is a matter of specific molds and is likely to continue to be so. Sometimes it is possible to determine a practical plasticizing capacity based on the experience of the machine maker with molds of various kinds encountered in plants where their machines are used. A discussion of the actual use-experience of the machines is likely to lead to much better understanding of plasticizing capacity. Purging is an important matter in some plants because of frequent color or material changes. Other plants will not expect to change materials or colors very often, and may wish to have some other and more important feature than easy purging.

The speed of the molding machine and its power are important considerations. The motor horsepower roughly determines the speed of clamping and injection, and is one of the largest factors in determining the cost of the machine. High-speed injection has been recommended for some time, and the newer molding machines have increased power plants with optional additional pumps and motors. It will be necessary to weigh the cost of such equipment against the actual needs in the molding plant and the possible extension of the scope of the molding plant in the future into what may be profitable operations. The number of dry cycles per hour is an important specification. This is especially true for machines that are to be run on more than four cycles per minute. The type of pump and the maximum pressure in the hydraulic system is a matter best left to the builder of the machine. Presumably, he has enough experience to know what is the best all-around arrangement and, if it is left to him, he must assume the responsibility for performance.

The tonnage requirements for clamping are subject to controversy. The rule-of-thumb that states the tonnage should be one ton per square inch of projected area of molding is very much an approximation. As the area of moldings increases, it has been found to be impossible to maintain this ratio. For example, large area moldings of 1,500 or 1,600 square inches have been molded successfully in presses having 1,000 tons of clamping force. Molding machine manufacturers in the United States generally have provided sufficient clamping tonnage commensurate with machine building costs. This is true also of the clamping methods which have been employed. Toggle clamps, modified toggles with wedges, and hydraulic clamping systems all have proved very satisfactory. This should be left as a matter of preference with the individual molding plant, and probably the clamping method should be placed far down on the list of importance in the principal specifications.

Optional Equipment

A great deal of optional auxiliary equipment is available. Enough different kinds of equipment are available as to make it possible to provide two or more attachments that do the same thing. A weigh feeder may be the control device selected to measure the amount of material that is placed in the mold. Nozzle pressure control devices also are available, and will perform a function similar to that of the weigh feeder. The combination of both types of equipment is helpful, but probably not necessary.

Some other features of injection molding equipment often are discussed in planning. A stuffer that brings the plunger part-way forward in preparation for the next injection stroke can be supplied on most molding machines. It has been suggested that this is a time-saving device, but it actually is of much greater advantage than the second or two it may save. Forcing the plastic to be under some pressure in the injection cylinder during the curing time of the part allows better heat transfer, and probably increases the heating efficiency by as much as 10%.

The safety-clamp closing feature can be added to most injection molding machines. This device cuts off the high pressure from the clamp end and, in some cases, opens the press if any resistance is encountered (such as a molded part that did not eject completely). For automatic operations, this is a necessity. It is not

necessary for custom molding operations to be under control of a press operator, but it is helpful for the few cases where the mold may be closed on a non-ejected part.

Hopper feeders and preheaters also are useful auxiliary equipment. Preheating the granules properly can increase the heating efficiency of a machine.

Maintenance and Service

The availability and quality of factory service on injection molding equipment is an important principal specification. If the molding plant is large and, therefore, can afford to have its own maintenance crew, factory service becomes less important. However, service on spare parts always is important.

Convenience of mechanical, hydraulic, and electrical maintenance is an important consideration. Details on the machine should be made available to the maintenance department for suggestions; sometimes, their preferences can be incorporated into a new machine without additional cost.

Pioneering Opportunities

Sometimes there is opportunity to try out new design features to the advantage of both the buyer and the builder. Generally, some special feature is in the back of the mind of someone in the molding plant, and this may be added to the machine if there is time to wait for the machine to be built. A consideration of the unique features in the various molding machines available should be made. Whether the unique features will be useful or detrimental is a question that has to be answered individually, based on the needs of the specific molding plant. Sometimes, such features can be the deciding factor in the purchase of a machine, especially when other factors more or less are equal.

An ideal accomplishment for a new molding machine is to provide 20% increased productivity compared to existing equipment, and have the potential of providing a further increase of 2% per year for the next 10 years. The earning power of a machine has to be increased during its life, else it may not be able to amortize itself before being worn out.

Plant Lay-Out Preparations

Careful planning should be done as completely as possible during the consideration stage for buying a new injection molding machine. If the machine is to be installed in an existing plant, it will be necessary to find room for it and provide power, water, air, and sewer facilities. The cost of such provisions often can be reduced if a period of several weeks or months lies ahead before the new machine is to be delivered. Changes which have to be made as part of regular maintenance can be made with the idea in mind of providing for the new machine when it arrives.

When a brand new plant is being set up, the planning can be different. However, it probably should be more elaborate to provide for future needs.

The Machine Builder

The reputation of the machine builder always is an important consideration. It is well worth spending a considerable amount of time talking with the builder about his machinery so as to make some evaluation of his intentions and his abilities.

Many times the question arises whether a new machine should be the same brand as others already in the molder's plant. Operators come to know individual machines well, and often are reluctant to try to operate another type that looks different. After a few weeks of operating a different kind of machine, on the other hand, some operators prefer to stay with it rather than go back to the previous type. The reasoning for staying with the same kind of machine is based on requiring a minimum stock of spare parts, but this is not always the best reason to continue with the same machine builder. If more appropriate machines are available from some other manufacturer, it is not very good planning to continue with the same line of machines for the stock-part reasoning. Many times when machines are old, they require frequent repairs and a large stock of repair parts. Possibly, this should be a signal to consider replacing more machines.

Financial Arrangements

Price comparisons between machines must be made carefully. It takes time to weigh the various bids in order to determine what is being offered for the money. A numerical difference between two prices is merely numerical, and does not indicate the difference in value of the machines. There is no way to determine this difference in value without comparing the over-all bids.

Financing terms, trading in old machines, and reselling services are considerations that must be met and solved. An old machine will not look as good to a prospective buyer as it looks to its present owner, because the buyer does not know enough of the history of the machine. This is a fact that should be remembered when estimating the resale value of a machine.

The availability of a machine may be highly important because planning has not allowed sufficient time to wait for a machine that may be more desirable, but is not available as soon. Machines sometimes become available before place is prepared for them in the molding plant. This can be as much of a problem as not having the machine available; when a machine is ready in the factory, there is pressure to ship it to make room for building the next machine.

The cost of installing a new machine is something that cannot be quoted by the machine builder. Each individual molding plant will have to estimate its own installation cost based on local conditions. The machine builder can supply foundation, power requirements, and other information that can be used in planning the installation and in estimating the cost.

Conclusions

It is suggested that a check-list of specific needs will be an ideal tool in planning to buy an injection molding machine. A number of people should work on this check-list to prepare it, and each department that is involved in the use of the machine will have something to contribute to the list of principal specifications.

Comparative Data on Injection Molding Machines.

Company name*	Clifton				Crown	De Mattia			Fellows	
Machine model	356A	356	357A	357	Twinmaster AT	G3	K2	M	3-125	6-200
Machine action	Auto.	Auto.	Auto.	Auto.	Auto.	Semi-auto.	Auto.	Semi-auto.	Auto.	Auto.
Machine type	Horiz.	Horiz.	Horiz.	Horiz.	Horiz.	Vert.	Horiz.	Horiz.	Horiz.	Horiz.
Clamping mechanism	Toggle	Toggle	Toggle	Toggle	Hydr.	Hydr.	Hydr.	Hydr.	Toggle	Toggle
Injection capacity, oz./shot	2¾	2¾	2¾	2¾	1-3/ram	4	4-6	12-.16	3	6
Casting area, sq. in.**	—	—	—	—	Approx. 50	45 approx.	80 approx.	135 approx.	30	70
Injection plunger stroke, in.	6½	6½	6½	6½	4	7¾	7¾	11½	3¼-5½	6-8½
Injection pressure on material, psi.	10,000	20,000	10,000	20,000	15,500-28,000 (on pre-plasticized materials.)	20,500	20,250	22,500	20,000 max.	20,000 max.
Plasticizing capacity, lbs./hr.***	60+	60+	60+	60+	100	70	100	150	45	75
Cycles/hour	600	420	1,080	780	1,800 max. (actual)	360 dry	600 dry	360 dry	600-840	490-680
Mold: Size, in.	10 x 12	10 x 12	10 x 12	10 x 12	18 x 18	14 x 23	12 x 22V 14 x 20H	16 x 32V 18 x 30H	17 x 18½	12 x 24H 15 x 21V
Daylight opening, in.	6¾	6¾	6¾	6¾	10¾-16¾	19 max.	20 max	32 max.	5-8	6-9
Thickness (min.-max.), in.	4-12	4-12	4-12	4-12	—	—	—	—	8-14	8-14
Locking force, tons	50	60	65	65	105	128	150	400	125	200
Clamp tie bars or rods: Diameter, in.	2¼	2¼	2¼	2¼	3	3	2½	5	2¼	3
Space between (V x H), in.	13½	13½	13½	13½	10	14¼ x 14¼	14¼ x 12¼	18¼ x 16¼	10½ x 12½	12¼ x 15¼
Hopper capacity, lbs.	20	20	20	20	80	50	50	100	50	75
Cylinder heating capacity, kilowatts	5.1	5.1	5.1	5.1	10	8.8	10	16.5	6 max.	12 max.
Motor hp.	10	10	10	10	30	20	20	30	15	20
Oil tank or reservoir capacity, gals.	40	40	40	40	135	100	150	160	120	140
Special features	Adj. matl. metering. Dual timers. Pushbutton control for manual, semi-auto., and auto. operation. Prepack control.				Twin injection rams to prevent packing of material into cavity. Preplasticizing. Positive shut-off.	Suitable for insert molding. Easy, rapid mold installing.	Can also be used as semi-auto. Extra-large platens. Auto. prepack.		Variable stroke adjustment. Speed-Flo heating cylinder.	
Optional features	Temp. controls and dwell timer on return stroke for auto. operation.				Choice of ¾" & 1¼" plunger diameters.		Variable clamp. Can be equipped with hydr. valves.	Auto.	Prepack & proposition device. (Gives up to 4½ oz. shots)	(Gives up to 9 oz. shots)
Approx. delivery time, weeks#	6-7	6-7	6-7	6-7	4-6	From stock	4-6	4-6	5-6	5-6

*Complete company names and addresses are as follows:
Clifton Hydraulic Press Co., 287 Allwood Road, Clifton, N. J.
Crown Machine & Tool Co., Inc., 2800 W. Lancaster St., P. O. Box 246, Fort Worth, Tex.
DeMattia Machine & Tool Co., Chelsea Rd., Clifton, N. J. (Distributed by Brosites Machine Co., 50 Church St., New York 7, N. Y.)
The Fellows Gear Shaper Co., Springfield, Vt.
Guy P. Harvey & Son Corp., 40 Spruce St., Leominster, Mass.
The Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Improved Machinery, Inc., Nashua, N. H.
Lester Engineering Co., 2711 Church Ave., Cleveland 13, Ohio
Lombard Governor Corp., Ashland, Mass.
Moslo Machinery Co., 2443 Prospect Ave., Cleveland 15, Ohio
National Automatic Tool Co., Inc., Plastics Machinery Div., Richmond, Ind.
Reed-Prentice Corp., Div. Package Machinery Corp., East Longmeadow, Mass.
Simplomatic Mfg. Co., 4416 W. Chicago Ave., Chicago 51, Ill.
Standard Tool Co., 217 Hamilton St., Leominster, Mass.
F. J. Stokes Machine Co., 5500 Tabor Rd., Philadelphia 20, Pa.
The Van Dorn Iron Works Co., 2685 E. 79th St., Cleveland 4, Ohio
Watson-Stillman Press Div., Farrel-Birmingham Co., Inc., Rochester 10, N. Y.

**Casting area is dependent on the injection pressure used for the different materials in relation to the clamping capacity of the platens, and the mold construction.

***Plasticizing capacity varies broadly with material selection, part design, injection speed, and mold cooling.

#Delivery time, as well as prices, should be substantiated in a formal quotation from the manufacturer.

Company name*	Fellows (Cont.)	Harvey						HPM		
Machine model	12-350	Formaton 2A	Formaton 3A	Formaton 4F	Formaton C	Formaton J-1½	Formaton J-2	200-H-6/8	300-HV-12/16	400-HV-20/28
Machine action	Semi-auto.	Auto.	Auto.	Auto.	Auto.	Auto.	Auto.	Semi-auto.	Semi-auto.	Semi-auto.
Machine type	Horiz.	Vert.	Vert.	Vert.	Vert.	Horiz.	Horiz.	Horiz.	Horiz.	Horiz.
Clamping mechanism	Toggle	Hydr.	Hydr.	Hydr.	Hydr.	Hydr.	Hydr.	Hydr.	Hydr.	Hydr.
Injection capacity, oz./shot	12-20	2	3	4	4	1½	2	6-8	12-16	20-28
Casting area, sq. in.**	115	25	37	—	—	—	—	—	—	—
Injection plunger stroke, in.	10½	8	8	7	—	10 max.	10 max.	10	12	12
Injection pressure on material, psi	21,300	20,000	20,000	20,000	20,000	20,000	20,000	20,000 max.	20,000 max.	20,000 max.
Plasticizing capacity, lbs./hr.***	150	30	50	60	50	40	50	80	135	200
Cycles/hour	700	260;690 max.	260;690 max.	250;625 max.	333 max.	460;690 max.	552 max.	—	—	—
Mold: Size, in.	33 x 33	15 x 9	16 x 10	18 x 14	16 x 9	12 x 12	12 x 12	15 x 26V 26 x 15H	30 x 20H 17 x 33V	36 x 26½H 20½ x 42V
Daylight opening, in.	14	—	—	—	—	5-15	5-15	25 max.	20	40-48
Thickness (min.-max.), in.	10-20	5-9	5-9	3 min.	5-9	5-15	5-15	6-10 min.	6-10 min.	9-15 min.
Locking force, tons	350	50	75	120	90	37½	50	200 max.	300 max.	450 max.
Clamp tie bars or rods: Diameter, in.	4¼	2	2	—	2	—	—	4	4½	5½
Space between (V x H), in.	20¼ x 20¼	—	—	—	—	—	—	15½ x 15½	17½ x 20½	21 x 27
Hopper capacity, lbs.	90	50	50	60	50	—	—	80	100	200
Cylinder heating capacity, kilowatts	21	2.8	4.2	6.8	4.2	2.7	3.4	10.8	21.6	35.4
Motor hp.	40	5	7½	10;15	10	5;7½	7½	30	45	75
Oil tank or reservoir capacity, gals.	125	—	—	—	—	—	—	85	120	160
Special features	(Gives up to 20 oz. shots)	Volumatic feed. Stainless steel heating cylinder.		For rotary table or insert molding.	Volumatic feeder. Stainless steel heating cylinder. Powered core removal. Mag. weigh - feed two-stage ejection.	Uniflow hopper. Vibratory Feeder. Feed compensator.		—	—	Weigh-Feeder
Optional features		Weigh-feed L-P mold closing. Two-zone mold temp. controls.	Product discharge.		Vacuum pump & controls. Discharge closure. Air wiper. Low-pressure mold closing. Hydraulic core pulling and mold unscrewing.	Magni-feed device. Low-pressure mold closing. Injection regulator.		Weigh-Feeder Auto. Control	Weigh-Feeder Auto. Control	Auto. Control
Approx. delivery time, weeks#	6-8	12	12	—	—	—	—	—	—	—

Company name*	HPM (Cont.)								IMPCO	
Machine model	650-HV-32/42	800-HV-48/64	800-HV-48/64 Long Stroke	1200-H-80/100	1200-H-80/100 Long Stroke	450-P-80	800-P-200	1500-P-300	VF-1.5	HA2-125
Machine action	Semi-auto.	Semi-auto.	Semi-auto.	Semi-auto.	Semi-auto.	Semi-auto.	Semi-auto.	Semi-auto.	Manual or Semi-auto.	Auto., Semi-auto. or Manual
Machine type	Horiz.	Horiz.	Horiz.	Horiz.	Horiz.	Horiz.	Horiz.	Horiz.	Vert.	Horiz.
Clamping mechanism	Hydr.	Hydr.	Hydr.	Hydr.	Hydr.	Hydr.	Hydr.	Hydr.	Hydr. & Toggle	Hydr.
Injection capacity, oz./shot	32-42	48-64	48-64	80-100	80-100	80	200	300	1½-3	3-3
Casting area, sq. in.**	—	—	—	—	—	—	—	—	—	—
Injection plunger stroke, in.	15	18	18	18	18	12	18	18	8	6
Injection pressure on material, psi	20,000 max.	20,000 max.	20,000 max.	20,000 max.	20,000 max.	20,000 max.	20,000 max.	20,000 max.	6,830-21,200	20,000
Plasticizing capacity, lbs./hr.***	300	300	300	400	400	200	300	400	30	75
Cycles/hour	—	—	—	—	—	—	—	—	600	950 dry
Mold: Size, in.	30 x 48H 48 x 30V	55 x 36H 31 x 55V	55 x 36H 36 x 55V	60 x 48H 40 x 68V	60 x 48H 40 x 68V	20½ x 42V 26½ x 36H	55 x 36H 36 x 55V	72 x 48H 48 x 72V	8½ x 13	10 x 14
Daylight opening, in.	42-58	55	84	60	104	40-48	55	106-120	6 approx.	15 approx.
Thickness (min.-max.), in.	12-30 min.	12-20 min.	22-30 min.	12-24 min.	32-44 min.	9-15 min.	22-30 min.	34-46 min.	6-12	9-15
Locking force, tons	650 max.	800 max.	800 max.	1200 max.	1500 max.	450 max.	800 max.	1500 max.	50	125
Clamp tie bars or rods: Diameter, in.	6½	7	7	9½	9½	8½	7	9½	2	2½
Space between (V x H), in.	30½ x 30½	36½ x 36½	36½ x 36½	40½ x 48½	40½ x 48½	21 x 27	36½ x 36½	48½ x 48½	8½ x 8½	7½ x 10½
Hopper capacity, lbs.	200	200	200	350	350	200	200	400	25	100
Cylinder heating capacity, kilowatts	37.4	37.4	37.4	44.3	44.3	48	48	48	3	13
Motor hp.	107½	127	127	100	100	75	202	150	5	30
Oil tank or reservoir capacity, gals.	400	400	600	400	600	185	600	1000	60	60
Special features	Weigh-Feeder	Weigh-Feeder	Weigh-Feeder	Weigh-Feeder	Weigh-Feeder	Rotary valve preplasticising unit with positive shot-measurement.			Low-Pressure Closing. Center or side ejectors, or ejection from compression. Proportional heating cylinder. Adj. Carriage travel. Injection pressure.	Low-Pressure Closing. Adjustable knock-out. Prepack or preposition. Volume fred.
Optional features	Auto. Control	Auto. Control	Auto. Control	—	—	—	—	—	Compression unit available	—
Approx. delivery time, weeks#	—	—	—	—	—	—	—	—	—	—

IMPCO (Cont'd.)

Company name*	IMPCO (Cont'd.)						
Machine model	HA4-175	VA4-175 19	HA8-265	HA12-300	VF-822A	HA28-600	VF800
Machine action	Auto., Semi-auto. or Manual	Manual or Semi-auto.	Auto., Semi-auto. or Manual	Auto., Semi-auto. or Manual	Manual or Semi-auto.	Semi-auto.	Semi-auto.
Machine type	Horiz. Hydr. & Toggle	Vert. Hydr.	Horiz. Hydr.	Horiz. Hydr. & Toggle	Vert. Hydr. & Toggle	Horiz. Hydr.	Vert. Hydr.
Clamping mechanism							
Injection capacity, oz./shot	4-6	4-6	8-10	12-16	16-22	25-32	32-48
Casting area, sq. in.**	—	—	—	—	—	—	—
Injection plunger stroke, in.	8-11	8-11	9	12	12½	12 max.	—
Injection pressure on material, psi.	21,750	21,750	23,000	22,400	15,100-21,000	21,200	30,000 max.
Plasticizing capacity, lbs./hr.***	75	75	100	120	75	275	275
Cycles/hour	660 dry	420 dry	750 dry	420 dry	260	250	240
Mold: Size, in.	13 x 20	13 x 20	16 x 25	19 x 25	23 x 29	29 x 40	28 x 40
Daylight opening, in.	9 approx.	9 approx.	14 approx.	12½ approx.	10 approx.	24-60 approx.	24 approx.
Thickness (min.-max.), in.	6-14¾	8-14	6-18	7¾-17¾	8-26	8-46	10-20
Locking force, tons	175	175	275	300	350	600	800
Clamp tie bars or rods: Diameter, in.	2¾	2¾	3¾	4	4	6	7
Space between (V x H), in.	12½ x 13½	13½ x 12½	16¾ x 15½	19¼ x 16	18 x 23½	30 x 24	24 x 28½
Hopper capacity, lbs.	110	110	110	110	60	200	110
Cylinder heating capacity, kilowatts	11	11	13.5	16	12	22	22
Motor hp.	20	20	30	30	20	75	60
Oil tank or reservoir capacity, gals.	60	60	75	110	85	185	375
Special features	Low-Pressure Closing. Adjustable knock-out.	Low-Pressure Closing. Adjustable knock-out.	Low-Pressure Closing. Adjustable knock-out.	Low-Pressure Closing. Adjustable knock-out.	Low-Pressure Closing. Side ejectors.	Low-Pressure Closing. Side ejectors.	Low-Pressure Closing. Side ejectors.
	Proportional heating on cylinder.						
	Feed baffle arrangement.		Prepack and/or preposition injection.	Feed baffle arrangement.	—	Quick-change cylinder. Volume feed.	—
Optional features	Compression unit available.	—	—	—	Compression unit available.	—	Compression unit available.
	Special electrical characteristics and special cycles can be provided on all machines.						
Approx. delivery time, weeks#	—	—	—	—	—	—	—

Lester

Company name*	Lester		
Machine model	1-V-4	L-2-4	L-2C-4
Machine action	Semi-auto.	Auto.	Auto.
Machine type	Vert. Toggle	Horiz. Toggle	Horiz. Toggle
Clamping mechanism			
Injection capacity, oz./shot	4	4	4
Casting area, sq. in.**	30 (on 16,600 psi.)	50 (on 20,000 psi.)	50 (on 20,000 psi.)
Injection plunger stroke, in.	10	6½	6½
Injection pressure on material, psi.	16,600	20,000	20,000
Plasticizing capacity, lbs./hr.***	—	—	—
Cycles/hour	(idling) 257	(idling) 600	(idling) approx. 1,028
Mold: Size, in.	13¾ x 18	13¾ x 19¼	13¾ x 19¼
Daylight opening, in.	9	6-9	6-9
Thickness (min.-max.), in.	7½-14¼	9-12	9-12
Locking force, tons	100	150	150
Clamp tie bars or rods: Diameter, in.	2	3½	3½
Space between (V x H), in.	14 x 12	14 x 12	14 x 12
Hopper capacity, lbs.	45	45	45
Cylinder heating capacity, kilowatts	7.7	10	10
Motor hp.	10	20	40
Oil tank or reservoir capacity, gals.	45	65	125
Special features	Compensating feed mechanism. For nylon molding. Low Pressure Closing.		
	—	Automatic Cycling 2-point ejection	2-point ejection
Optional features	—	—	—
	Pneumatic Die Wipers Stuffer Available.		
	—	—	—
Approx. delivery time, weeks#	—	—	—

Lester (Cont.)

Company name*	Lester (Cont.)			
Machine model	L-2A-8	L-2-12	L-3-20	L-3½-60
Machine action	Semi-auto.	Semi-auto.	Auto.	Auto.
Machine type	Horiz. Toggle	Horiz. Toggle	Horiz. Toggle	Horiz. Toggle
Clamping mechanism				
Injection capacity, oz./shot	8	12	20	60
Casting area, sq. in.**	110 (on 20,000 psi.)	138 (on 20,000 psi.)	200 (on 21,000 psi.)	250 (on 24,000 psi.)
Injection plunger stroke, in.	10	14	13½	16
Injection pressure on material, psi.	20,000	20,000	21,000	24,000
Plasticizing capacity, lbs./hr.***	—	—	—	—
Cycles/hour	(idling) approx. 410	(idling) approx. 300	(idling) approx. 260	(idling) approx. 200
Mold: Size, in.	23 x 31¾	28¾ x 28	28 x 40	28¾ x 50
Daylight opening, in.	10	12	14	16¼
Thickness (min.-max.), in.	13-16	13-16	15-21	23¾-26¾
Locking force, tons	300	400	600	750
Clamp tie bars or rods: Diameter, in.	6¼	6½	8	9
Space between (V x H), in.	23¾ x 18½	26 x 18½	28¼ x 26	29 x 20
Hopper capacity, lbs.	55	100	125	200
Cylinder heating capacity, kilowatts	11.1	13.6	17.25	39.5
Motor hp.	30	30	50	50
Oil tank or reservoir capacity, gals.	130	137	190	200
Special features	Compensating feed mechanism Adaptable to nylon molding.			—
	—	—	—	
	2-point ejection	2-point ejection	—	2-speed inj
	Plunger Advance			
Optional features	Auto. cycling available.			
	Pneumatic Die Wipers. Stuffer Available.			
	Outside ejection available.	Outside ejection available.		
Approx. delivery time, weeks#	—	—	Mold overload	—

Lombard

Company name*	Lombard				
Machine model	2414-6 Auto. Semi-auto. Manual	3214-12 Auto. Semi-auto. Manual	3220-12 Auto. Semi-auto. Manual	3214-16 Auto. Semi-auto. Manual	3220-16 Auto. Semi-auto. Manual
Machine action					
Machine type	Horiz. Toggle	Horiz. Toggle	Horiz. Toggle	Horiz. Toggle	Horiz. Toggle
Clamping mechanism					
Injection capacity, oz./shot	6	12	12	16	16
Casting area, sq. in.**	110	310	310	310	310
Injection plunger stroke, in.	6½-10	12	12	12	12
Injection pressure on material, psi.	20,000 max.	20,000 max.	20,000 max.	20,000 max.	20,000 max.
Plasticizing capacity, lbs./hr.***	100	125 (dry)	125 (dry)	150 (dry)	150 (dry)
Cycles/hour	—	420	420	350	350
Mold: Size, in.	14⅜ x 28	10¼ x 36	10¼ x 36	10¼ x 36	10¼ x 36
Daylight opening, in.	32 max.	36 max.	42 max.	42 max.	42 max.
Thickness (min.-max.), in.	—	8-22	8-22	8-22	8-22
Locking force, tons	215	325	325	325	325
Clamp tie bars or rods: Diameter, in.	3¼	4	4	4	4
Space between (V x H), in.	15 x 15	20¼ x 20¼	20¼ x 20¼	20¼ x 20¼	20¼ x 20¼
Hopper capacity, lbs.	100	100	100	100	100
Cylinder heating capacity, kilowatts	16	24.4	24.4	24.4	24.4
Motor hp.	25	30	30	30	30
Oil tank or reservoir capacity, gals.	100	150	150	150	150
Special features	Stuffing arrangement; Injection Stroke adjustment.	Stuffing arrangement; High-speed plunger approach attachment; Plunger positioning; Heated nozzle; Separate speed controls for plunger and linkage.			
Optional features	Auto. compensating Weigh-Feeder.	50-hp. motor. Hi-pressure ram (30,000 psi.). Larger platens. Core pulling and inserting. Auto. nozzle positioning. Heated nozzle suitable for nylon.			
		Low-press. mold closing.			
Approx. delivery time, weeks#	—	2	2	2	2

Company name*	Moslo						NATCO			
Machine model	74-7-2	74-12-2	75-8-4	75-15-4	76-6-4	Duplimatic 11	300	400	800	800-X
Machine action	Auto.	Auto.	Auto.	Auto.	Auto.	Semi-auto.	Semi-auto.	Semi-auto.	Semi-auto.	Semi-auto.
Machine type	Horiz. Toggle	Horiz. Toggle	Horiz. Toggle	Horiz. Toggle	Horiz. Toggle	Vert. Toggle	Horiz. Hydr.	Horiz. Hydr.	Horiz. Hydr.	Horiz. Hydr.
Clamping mechanism										
Injection capacity, oz./shot	2	2	4	4	4	3	Single/double feed.			
							16-20	28-35	80-100	80-100
Casting area, sq. in.**	24	20	54	50	54	20 max.	Depends upon part design and plastic material used.			
Injection plunger stroke, in.	5½	5½	2-6½	2-6½	6½	8	15	15	21	21
Injection pressure on material, psi.	16,550 max.	16,550 max.	20,000 max.	20,000 max.	20,000 max.	17,550 max.	20,000; 30,000	20,000; 30,000	20,000; 30,000	20,000; 30,000
Plasticizing capacity, lbs./hr.***	50 (dry)	50 (dry)	70 (dry)	70 (dry)	90 (dry)	50	130	165	350	350
Cycles/hour	1,200	950	700	580	780	450	Estimated cycle time furnished upon receipt of plastic part specifications.			
Mold: Size, in.	9 x 12	9 x 12	11⅞ x 15	11⅞ x 15	11⅞ x 15	6 x 8 (top) 6x17(bottom)	33 x 21¼ max.	38 x 24¼ max.	55 x 36¼ max.	55 x 36¼ max.
Daylight opening, in.	7	12	8	15	8	2½	32-42½ max.	38-50 max.	55-85 max.	55-85 max.
Thickness (min.-max.), in.	5½-12	5½-12	8-15	8-15	8-15	3-3½	8-18½ min.	12-24 min.	15-45 min. in 5-inch increments.	15-45 min.
Locking force, tons	60	50	135	135	150	75	325 max.	425 max.	850 max.	850 max.
Clamp tie bars or rods: Diameter, in.	1¾	1¾	2¼	2¼	2¼	—	4¼	5	7	7
Space between (V x H), in.	6¾ x 9¼	6¾ x 9¼	11 x 12½	11 x 12½	11 x 12½	—	21½ x 21½	25 x 25	36½ x 36½	36½ x 36½
Hopper capacity, lbs.	75	75	75	75	75	75	100	200	500	500
Cylinder heating capacity, kilowatts	6	6	7	7	8	6	16	24	40	40
Motor hp.	7½	7½	10	10	15	5	47½ total	47½ total	82½ total	157½ total
Oil tank or reservoir capacity, gals.	58	58	77	77	90	90	175	175	550	550
Special features	Heat controls on cylinder & nozzle.					Shifting table for dual lower mold platen permits two-section molding and continuous operation.	Vibratory feed. Water-cooled plunger. Vibratory feed. Adjustable two-speed, two-pressure injection. Adjustable mold clamping pressure. Prepack, and preposition. Mold contact slow-down. Automatic lubrication.			
			Modified J.I.C. control circuit. Plug-in Controls.							
Optional features	70-lb. plasticizing cylinder. 90-lb. plasticizing cylinder.					70-lb. plasticizing cylinder.	Weigh feeder. Nozzle for nylon molding. Plunger & feed bushing for 30,000 psi. pressure. Automatic cycle control with low-pressure mold protection.			
Approx. delivery time, weeks#	2	2	4-6	4-6	4-6	2	Built in stock quantities for prompt delivery.			

Company name*	Reed-Prentice						Simplomatic	Std. Tool		
Machine model	175T-4/8	275T-8/10	300TA-12/16	400T-16/20	450T-20/24	600T-32	Plasticor A-2	SP20-25-13	Automolder SP20-50-13	SP20-75-13
Machine action	Auto.	Semi-auto.	Semi-auto.	Semi-auto.	Semi-auto.	Semi-auto.	Manual, Bench model	Automatic	Automatic	Automatic
Machine type	Horiz. Toggle	Horiz. Toggle	Horiz. Toggle	Horiz. Toggle	Horiz. Toggle	Horiz. Toggle	Vertical Manual	Horiz. Hydr.	Horiz. Hydr.	Horiz. Hydr.
Clamping mechanism										
Injection capacity, oz./shot	4-6	8-10	12-16	16-20	20-24	32	¼	2	2	2
Casting area, sq. in.**	75	125	150	175	200	300	0.280	20	40	60
Injection plunger stroke, in.	8⅛	11	13	13	13	10	3	4	4	4
Injection pressure on material, psi.	17,800	20,000	20,000	23,000	21,000	19,350	25,000 max.	14,000-26,000	14,000-26,000	14,000-26,000
Plasticizing capacity, lbs./hr.***	75	120	125	130	150	180	2½	30-40	30-40	30-40
Cycles/hour	600 max.	470 max.	360 max.	250 max.	200 max.	172 max.	225 max.	1,200 (dry)	2,000 (dry)	2,000 (dry)
Mold: Size, in.	22 x 13½	22½ x 14¼	29 x 20½	38 x 23½	45 x 25½	54 x 30½	2½ x 2	9 x 10 max.	9 x 10 max.	9 x 10 max.
Daylight opening, in.	5-8	6¼-10¼	7½-12½	8-14	16 max.	24	—	12¾ max.	18 max.	12¾ max.
Thickness (min.-max.), in.	6-14	8½-16	8-20	7-30	7-24	12-32	1	6 min.	9 min.	6 min.
Locking force, tons	175	275	300	400	450	600	¾	25	100	100
Clamp tie bars or rods: Diameter, in.	3	3¼	4	4½	5	6	—	—	—	—
Space between (V x H), in.	13½ x 13½	11¼ x 14¼	15 x 20½	23½ x23½	22½ x 25½	26½ x 30½	—	9½ x 12	9½ x 12	9½ x 12
Hopper capacity, lbs.	100	150	150	150	150	150	1½	125	125	125
Cylinder heating capacity, kilowatts	13.6	17.0	21.7	24.5	30.3	24.1	0.18	3.15	7.9	7.9
Motor hp.	15	25	30	30	40	50	—	15	15	15
Oil tank or reservoir capacity, gas.	80	150	150	150	150	200	—	60	60	60
Special features	Automatic ejection.						Operates on 100-125 psi. air line. Auto. shutoff valve in cylinder.	—	—	—
			2-stage injection	2-stage injection	"Prefill" injection	"Prefill" injection		Heat controls		
	Built-in stuffing arrangement							Instrument stand		
	Zoned temperature control									
	Adjustable mold stroke.									
Optional features	4th timer for auto. control.			Nylon molding equipment.						
	Low-pressure die closing.									
	Selector switch for heater. Long stroke up to 12 in.		Larger capacity cylinder. Long stroke up to 20 in.							
Approx. delivery time, weeks#	—	—	—	—	—	—	2-3	4-5	4-5	4-5

Company name*	Stokes		Van Dorn			Watson-Stillman				
Machine model	701	700	H-200	H-250	H-260	1E	2E-36	5ES-215	6E-100	16ES-400
Machine action	Auto.	Auto.	Semi-auto.	Auto.	Auto.	(Table Model) Manual	Semi-auto.	Manual & Auto.	Manual & Semi-auto.	Manual & Semi-auto.
Machine type	Vertical Clamp	Horiz.	Horiz.	Horiz.	Horiz.	Vert.	Vert.	Horiz.	Vert.	Horiz.
Clamping mechanism	Toggle	Straight Hydraulic	Toggle	Toggle	Toggle	Hydr.	Hydr.	Hydr.	Hydr.	Hydr.
Injection capacity, oz./shot	2	4	2	2½	2½	1 max.	2 max.	5 max.	6 max.	16 max.
Casting area, sq. in.**	20	48	20	20+	20+	—	18	107	50	200
Injection plunger stroke, in.	4½	8	7	7	7	6½	6½	8	7	10
Injection pressure on material, psi.	12,100	16,000	10,000	12,000 approx.	12,000 approx.	14,700	19,000	20,000	20,000	21,000
Plasticizing capacity, lbs./hr.***	45	60	12	22+	30+	—	25	80	75	150
Cycles/hour	1030	515	480-600	720 max.	720 max. (dry)	300 max.	300 max.	600	300 max.	300 max.
Mold: Size, in.	14 x 8½	21 x 12	8 x 10 max.	8 x 10 max.	8 x 10 max.	—	12 x 13	14¼ x 24 max.	20 x 21 max.	20 x 36 max. & 21 x 33 max.
Daylight opening, in.	14-20½	21¾	6	6	6	—	5	24	22	34
Thickness (min.-max.), in.	8½-15	8-13¾	8½ x 3	8½ x 3	8½ x 3	—	7 min.	12 min.	10 min.	12 min.
Locking force, tons	50	120	27	30	30	1,200 psi.	36	215	100	400
Clamp tie bars or rods: Diameter, in.	1¾	3½	1¾	1¾	1¾	1	2	3¼	4½	4½
Space between (V x H), in.	17¾ x 6¾	12 x 12	9	9	9	—	—	—	—	—
Hopper capacity, lbs.	30	60	6	20	20	—	15	—	50	200
Cylinder heating capacity, kilowatts	5.4	6	1.68	2.6	3.135	0.6	2	—	7	20.7
Motor hp.	7½	15	5	7½	7½	2	10	40	20	45
Oil tank or reservoir capacity, gas.	70	40	20	20	20	3	40	—	42	190
Special features	Inj. nozzle shut-off. Prepack. Positive ejection.	Prepack. Positive ejection.	Automatic part ejector. Water-cooled hopper and oil tank. Adj. material metering. Oversize heater.			—	—	Push-button manual. Auto. for single or multiple cycles.	Push-button manual or semi-automatic.	
Optional features	None required.		Machines for molding vinyls & Kel-F. Repeat cycle timer.			Adj. relief valve for pressure.	Self-compensating feeder. Adj. injection platen height.	Adj. plunger speed. Cylinder heat control. Prepositioning plunger. Self compensating feed. Inching of stroke.		
Approx. delivery time, weeks‡	3-4 Average	3-4 Average	4-6	4-6	4-6	2	2	—	3-6	2-4

Company name*	Watson-Stillman (Cont'd.)								
Machine model	24ES-425	32ES-650	48ES-1000	48ES-1000-LS	PE64-650	PE-100-650	PE-175-1000	PE-175-1000-LS	
Machine action	Manual & Semi-auto.	Manual & Semi-auto.	Manual & Semi-auto.	Manual & Semi-auto.	Manual & Semi-auto.	Manual & Semi-auto.	Manual & Semi-auto.	Manual & Semi-auto.	
Machine type	Horiz.	Horiz.	Horiz.	Horiz.	Horiz.	Horiz.	Horiz.	Horiz.	
Clamping mechanism	Hydr.	Hydr.	Hydr.	Hydr.	Hydr.	Hydr.	Hydr.	Hydr.	
Injection capacity, oz./shot	24 max.	32 max.	48 max.	48 max.	90 max.	120 max.	175 max.	175 max.	
Casting area, sq. in.**	200	325	500	500	650	650	1,000	1,000	
Injection plunger stroke, in.	14½	14½	18½	18½	14½	14½	18½	18½	
Injection pressure on material, psi.	20,000	20,400	21,000	21,000	20,000 max.	20,400	21,000	21,000	
Plasticizing capacity, lbs./hr.***	250	300	500	500	285	335	550	550	
Cycles/hour	420 max.	300 max.	150 max.	120 max.	—	—	—	—	
Mold: Size, in.	27 x 45 & 25 x 40½ max.	27 x 45 max. & 27 x 43½	40 x 60 max.	40 x 60 max.	27 x 43½ max. & 27 x 45	27 x 45 max.	40 x 60 max.	40 x 60 max.	
Daylight opening, in.	34	54	66	108	54	54	66	108	—Tan Eso
Thickness (min.-max.), in.	12 min.	12 min.	12 min.	42 min.	12 min.	12 min.	12 min.	42 min.	
Locking force, tons	450	650	1,000	1,000	650	650	1,000	1,000	
Clamp tie bars or rods: Diameter, in.	6	6	7½	7½	6	6	7½	7½	
Space between (V x H), in.	—	—	—	—	—	—	—	—	
Hopper capacity, lbs.	300	300	200	200	78,000 cu. in.	7,880 cu. in.	200	200	
Cylinder heating capacity, kilowatts	26	29	52.3	52.3	32.2	40	65.7	65.7	
Motor hp.	70	70	135	135	70	70	135	135	
Oil tank or reservoir capacity, gas	250	260	540	540	250	260	540	540	
Special features	Push-button manual or semi-automatic. With preplasticizer unit								
Optional features	Adj. plunger speed. Cylinder heat control. Prepositioning plunger								
	Self compensating feed. Inching of stroke.								
	Weigh-feeder. Preplasticizer.								
Approx. delivery time, weeks‡	2-4	2-4	26	10-12	2-4	2-4	26	10-12	

Dry Coloring for Injection Molding

A new method of dry-coloring thermoplastics for injection molding has been developed by W. R. Grace & Co.'s Polymer Chemicals division. The process involves the use of a single breaker plate which has, to date, given dispersion equal to or better than the much more expensive method of color compounding. Dry blending is not new; however, until now it required the use of small gates and small nozzle orifices which could not accommodate the molding of large and/or thick sections.

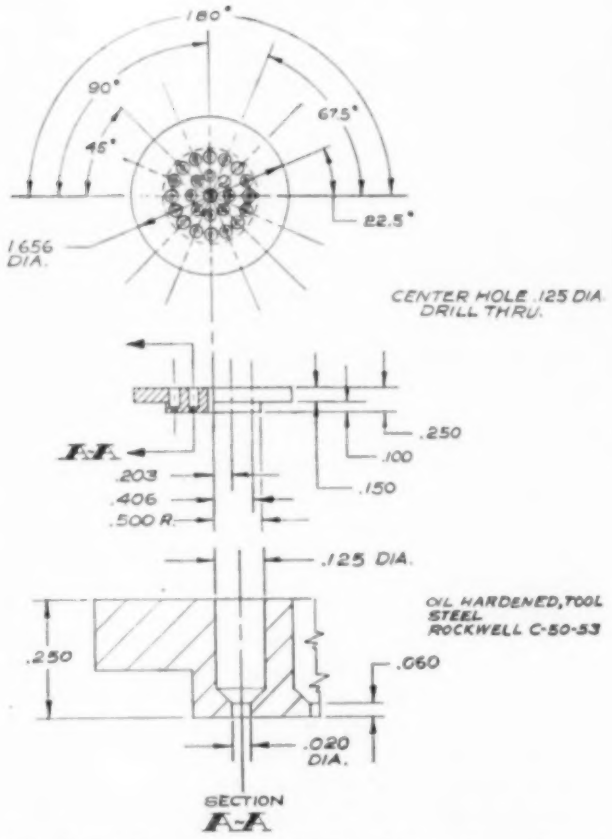
Since this is particularly true with the high-density polyethylenes such as Grex, Grace undertook an extensive program to develop a suitable dispersion aid. The breaker plate was the answer. It consists of a single plate with multiple perforations of a modified Venturi design. Land area and orifice size at the nozzle end of the breaker plate is of greatest importance, if optimum color dispersion is to be achieved. There is no noticeable pressure drop or back pressure buildup when using this plate, a prime requisite for successful dry coloring.

Choice of proper colorant is a must, and micropulverized pigments should be used. For best results, tumbling for 30-45 minutes without wetting agents or lubricants is recommended. Specifications for the plate

Disc at upper right was molded using Grace's breaker plate inserted behind the injection nozzle. Dry coloring without breaker plate is shown at the left.

are available to molders from Grace's Polymer Chemicals division, free of charge. It should enable the molder or extruder to stock base resins and colorants, thus affording both inventory and warehousing savings. The accompanying sketch shows plate layout as designed for use with a 12-ounce Hydraulic Press Mfg. unit; however, Grace is presently undertaking design modifications for other size nozzles and machines.

—THE END



Basic layout for a dry-color breaker plate, to be used on a 12-ounce machine.

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Optimum Aromatic Amine–Hardened Epoxy–Glass Laminates

Processing means to achieve optimum strength/weight properties under stipulated conditions were obtained by an extensive investigation program.

WHILE the advent of fiberglass-reinforced laminated plastic resulted in volume plastic usage in the aircraft industry, it cannot be said that these plastics were truly structural stress-carrying materials. The reason for this is quite simple. The aircraft designer must think in terms of weight penalty and, hence, in terms of specific strength; i.e., strength: weight ratio. In the past, aluminum possessed this property of specific strength to a greater degree than any other material, including reinforced plastics. Only recently, has another material, fiberglass-reinforced epoxy, appeared to challenge aluminum. More specifically, this material is aromatic amine-hardened epoxy with glass-cloth reinforcement.

Figure 1 is a plot of the relative specific compressive strengths of several aircraft structural materials. These curves, developed for a structural index of 3,000 psi. by our Structures Research department, were the direct cause of the study that is the subject of this paper. The reason for the special interest generated is that the curves show reinforced epoxy to be superior to all other structural aircraft materials considered at temperatures lower than about 250° F.

Purpose of this study was to determine those press-molding and post-curing conditions that would result in the highest possible combinations of edgewise compressive strength and modulus for pre-impregnated aromatic amine-catalyzed epoxy reinforced with 181 glass cloth, Volan-A finished, and to determine that strength and modulus.

Literature surveyed prior to this study indicated the general superiority of the lower molecular-weight epoxies as general-purpose press and bag molding resins with aromatic amines as the preferred hardeners, to yield the high physical properties essential to structural aircraft laminates.

An earlier portion of the study, not covered in this paper, had shown the epoxies of viscosity approximating 100 poises to have the best balance of properties for good laminate molding. The same study had shown the (liquid) eutectic types of aromatic amines to be the most practical for use in production, owing to their ease of handling and long shelf life. Resultant physical prop-

*Now Chief Process Control Engr., Grand Central Rocket Co., Redlands, Calif.

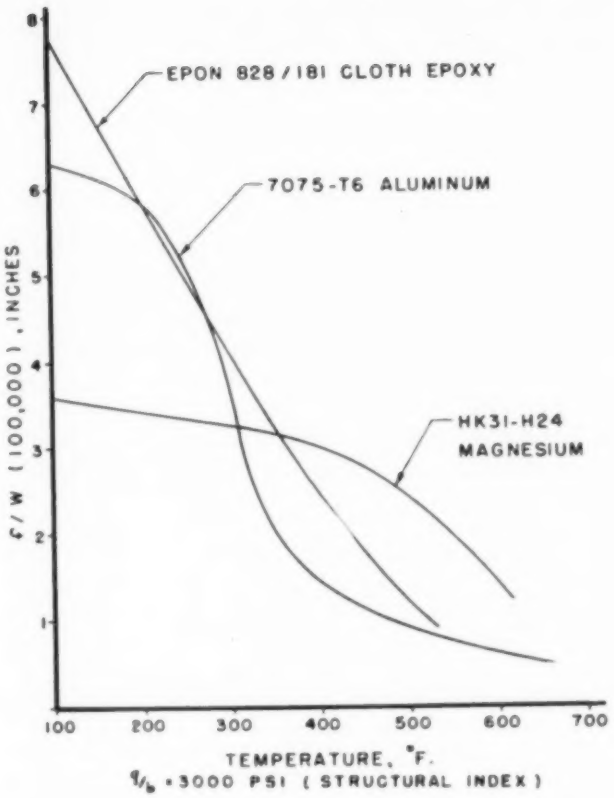


Fig. 1. Effect of temperature on compressive stress/density of some structural materials.

erties had been demonstrated as equivalent to those achieved using single (crystalline) aromatic amine-hardener systems, such as methaphenylene diamine.

Further study had demonstrated the serious handling problems inherent in "wet" press molding of glass cloth epoxies. These problems, of course, revolve around the difficulty of handling wet, limp cloth and maintaining optimum resin content in moldings. Therefore, this paper covers the "optimizing" of a carefully-selected system containing Epon 828 epoxy resin; Dion RP7 hardener; 181 Volan-A Glass cloth as reinforcement; and 40% pre-impregnate resin content. Further details on the system are covered in Table 1.

Table 1. Miscellaneous Properties of Epon 828* and Dion RP7**

Resin Epoxide Equivalent	175-210
Viscosity, cps.	16,000
Formulation: pph. Hardener	14
Ambient Pot Life	10 hours
Viscosity, cps. in two hours	9,200
Gel time, min., 212° B. bath	40
Pre-impregnate shelf life, months at 40° F.	3

*Trade mark of Shell Chemical Co., Union, New Jersey
**Trade mark of Chemical Process Co., Redwood City, Calif.

The pre-impregnated cloth used in the press-molding portion of the study was made by hand-spreading a pre-measured weight of resin over an accurately-weighed cloth. This then was B-staged at room temperature between sheets of cellophane and stored at 40° F., where it exhibited a 90-day shelf life. The laminate used for the post-curing portion of this study was made using vacuum-bagged panels produced in an earlier study. Consequently, the physical properties tabulated here are not as high as those achieved by press-molding.

Test Procedure

Three steps were followed in isolating optimum molding conditions for the laminates. The first comprised molding two-inch square 17-ply (⅛-inch thick) specimens over a series of pressure-temperature conditions, and inspecting them visually. The second step comprised narrowing down that area of conditions considered best in the inspection of the first series of panels by the molding and testing of four by five-inch 17-ply panels in accordance with those conditions. This second series was tested for flexural strength and flexural secant modulus. The results were plotted in triordinate graphs in order to detect the optimum conditions of molding. The third step in determining molding optimae comprised molding a series of four by five-inch 17-ply panels, testing them in edgewise compression, and studying the results statistically.

Augmenting these data, the critical time cycles were determined by curing specimens in a series of time steps, water quenching the specimens, and determining degrees of polymerization by means of acetone extraction in a Soxhlet apparatus.

A statistical approach similar to that used for molding evaluation was taken in locating post-curing optimae. In this instance, available vacuum-molded 12-ply (⅛-inch) panels were used for the experiment, and optimums determined by post-curing specimens in a series of time-temperature conditions and combinations. Results were predicated on the basis of edgewise compressive strength.

Formulations were prepared according to the ratio given in Table 1, the two liquid ingredients being weighed into a single paper container and mixed thoroughly by hand, using a spatula. Glass cloth used in the experiment was type 181, Volan-A finished. Cloth panels were cut and weighed accurately, then accurately measured weights of resin formulation were impregnated into individual plies, using Teflon paddles in order to obtain a resin content of 40%. Cloth plies were confined between sheets of cellophane, and B-staged at room temperature. B-staging was carried just to the point of zero ambient tack, and the pre-impregnate then stored at 40° F. until used.

Previous to molding, the pre-impregnate was cut to precise dimensions, using a knife and straight edge. Plies were stacked with successive plies reversed in order to intermesh the glass filaments. In this manner, results were rendered more consistent and glass contents of approximately 79% achieved.

Press molding was done in an electrically-heated hydraulic press, force-calibrated by means of load cells, and with temperature controlled within ±6°. Specimens were molded between ⅛ inch thick aluminum cauls, with Garan 225 used as the parting compound.

Post-curing was done in a forced-draft, hot-air oven that was controlled thermostatically.

Molding Conditions

For Step 1 indicated above, two-inch square, 17-ply pre-impregnated specimens were molded at pressures of 15, 40, 60 and 75 psi., each at temperatures of 200, 225, 250, 275, and 300° F. Molding time was 20 minutes. After molding, the specimens were inspected for thickness, degree of resin flow, evidence of resin richness or starving, and of resin "boiling."

The pressure-temperature range adjudged best by inspection of the panels molded in Step 1, was selected as the range for closer inspection in Step 2. Therefore, four by five-inch 17-ply pre-impregnated panels were molded at pressures of 20, 40, and 60 psi., each at 225, 260, and 275° F. Panels were cut to yield three one by four by approximately ⅛-inch thick flexural specimens, and these were post-cured for three hours at 200° F., followed by three hours at 300° F., and then tested across a two-inch span to determine flexural strength and modulus.

Moduli calculated from these data were found using the 70% of ultimate secant method of ATC, according to it's Test Method VIII (1).*

For Step 3 to find the precise molding optimums for edgewise compressive strength, additional four by five-inch 17-ply panels were molded for 20 minutes each at 25, 50, and 75 psi. for each of the temperature levels of 225, 250, and 275° F. One by three by approximately ⅛-inch specimens were cut from each panel and tested in edgewise compression according to ATC Test Method I (1).

The time cycle for this portion of the study was determined by finding the degree of polymerization, using the following procedure:

A series of two-inch square 17-ply pre-impregnated panels were molded between ⅛-inch aluminum cauls at 25 psi. and 225° F. press temperature. Panels were molded at total times of 3, 5, 10, 12, and 15 minutes; the time being measured from insert of ambient caul assembly to removal of assembly and quench in cold water.

Three coupons, approximately ⅛ by ½ by 1½ inches in size, were cut from each of the test panels and weighed on a precision balance to the nearest tenth of a milligram. The coupons then were inserted in extraction thimbles and acetone-extracted in a standard Soxhlet apparatus for five hours. After extraction, the samples were dried at 180° F. for one hour in a drying oven, and again weighed to the nearest tenth of a milligram. Next, the coupons were placed in covered crucibles and the balance of the resin was removed by heating over a Meker burner at approximately 1,000° F., following which they were cooled and again weighed to the nearest tenth of a milligram. Degree of polymerization then was calculated from the weight loss during extraction.

Post-curing Procedure

Optimum physical properties of laminates are not obtained through reasonable press cycles continued to more complete polymerization. Additional "cure" at elevated temperature apparently is required to accomplish further cross-linking. For reasons of economics, this process, which is referred to as post-curing, is generally conducted in an oven rather than in a press.

The desirability of post-curing epoxy laminates has been stated by a number of sources. There is little consistency, however, in the post-curing cycles recommended by the various sources. Therefore, it was deemed essential to this study to determine the effect of post-curing on the physical properties of the laminates, and, further, to establish the optimum post-curing cycle. Edgewise compressive strength was chosen as the definitive property because of its significance in aircraft design.

The factors in a post-curing procedure that affect ultimate compressive strength include time of post-cure, post-cure temperature, variation in material from sheet to sheet, and combinations of time-temperature cycles. An experiment was designed which incorporated all of these factors. A factorial experiment design was used, and the results were analyzed in order to determine the effect of each parameter, both separately and jointly.

Detail procedure of the experiment was as follows: Flat test panels, each reinforced with 12 plies of 181, Volan-A finished glass cloth, were prepared using the vacuum bag technique. Careful control was exercised in the preparation of the panels in order to achieve good uniformity and thickness tolerance. From these panels, test coupons in excess of one by three inches were rough cut in the warp direction for edgewise compressive evaluation. The position of each coupon on each panel was noted, and three coupons were tested for each post-cure treatment. Complete randomization of post-cure temperatures and coupon position was practiced, using tables of random numbers.

Post-cure temperatures selected for this experiment were ambient and 100, 200, 300 and 400° F. The post-cure times selected were one, two, and three hours. Proper combination of post-cure temperature, coupon position, and post-cure duration made it possible to study a large range of treatment effects and post-curing cycles in one experiment. A tabulation of the conditions is given as Table 2, which shows use of both single and dual cycles of post-curing.

The coupons were treated, according to the plan of Table 2, in a circulating hot-air oven, machined, and tested for edgewise compressive strength according to ATC Test Method I (1).

Test Results

Figure 2 illustrates the effects of various molding conditions on two-inch square, 17-ply specimens. It may be seen readily that the tendency is for the flow to be excessive at the higher temperatures, and inadequate at the lower temperatures. As a function of this, higher pressures tend to yield "starved" specimens, while lower pressures produce resin-rich specimens. Flow is essentially nil at 200° F., while the volatile components of the formulation begin to boil at 300° F.

From a study of these specimens, it was concluded that conditions approximating 50 psi. and 250° F.

*Numbers in parentheses refer to Bibliography at end of article.

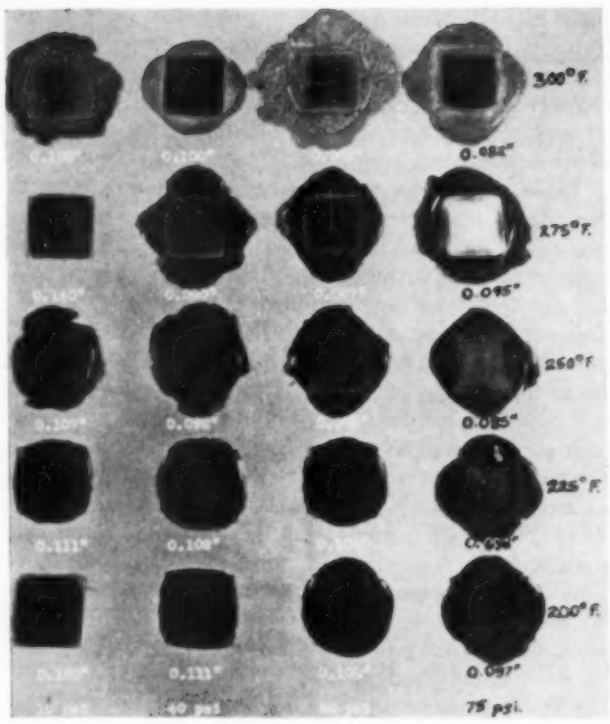


Fig. 2. Effect of pressure and temperature on molding characteristics of epoxy-glass laminates in two-inch square specimens.

appeared to be the most promising. The second step of the experiment was pursued in order to rough-check this conclusion quantitatively.

The results obtained by molding four by five-inch, 17-ply pre-impregnated panels at pressures of 2, 40, and 60 psi. and temperatures of 225, 250, and 275° F., and then testing in flexure, were calculated and plotted in the triordinate graphs of Figures 3 and 4. The peak value of flexural strength, 89,000 psi., was obtained at 50 psi. and 275° F. The peak value of flexural modulus, 4.9×10^6 psi., was defined more sharply at 40 psi. and 250° F.

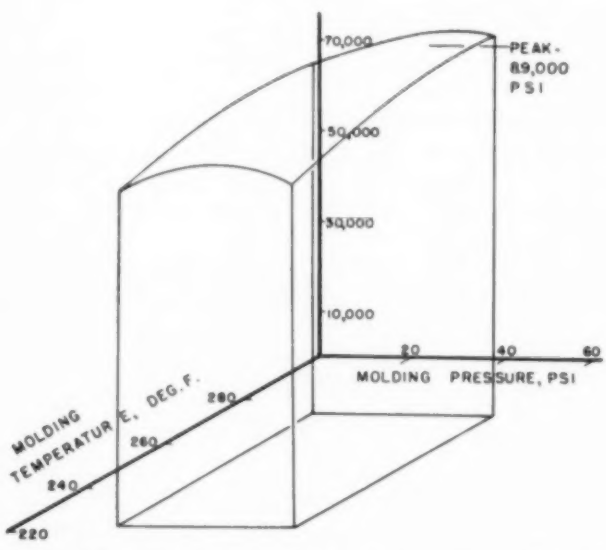


Fig. 3. Effects of molding pressure and temperature on flexural strength of epoxy-glass laminates.

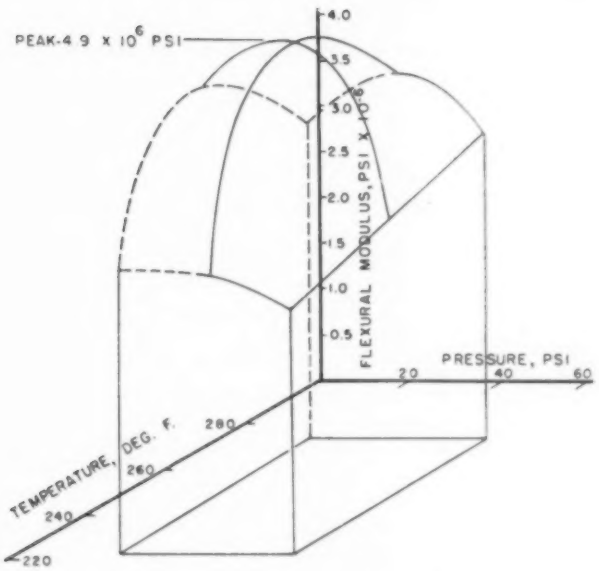


Fig. 4. Effects of molding pressure and temperature on flexural modulus of epoxy-glass laminates.

Having found that the optimum molding conditions surely lay in the area surrounding 250° F. and 50 psi. pressure, a statistical experiment was designed to locate as precisely as possible the physical optimums. For the benefit of those not familiar with this technique, a short discussion of the statistical method is given.

In every experiment, there is an experimental error that arises from two sources; lack of uniformity of the material, and variability of the experimental technique. These are the basic errors that apply to a single elementary experiment. Nothing can be done statistically to obviate this error. It can be reduced only by improving the material or the experimental technique.

Some of the obvious advantages to be gained from statistically designed experiments are that considerable thought must be given to objectives and to a detailed description of the experiment and method of analysis prior to beginning work. The thought that precedes actual experimental procedure will in many cases clarify the objectives. The scope of the experiment will many times be limited or enlarged to meet the stated objectives. It may be wiser in some instances to abandon the experiment rather than make an ineffectual effort. It has been demonstrated that considerable time and money are saved by resorting to statistical experimentation as a replacement for the casual Edisonian approach.

A preliminary analysis of variants in the compressive test results for press-molded laminates indicated that there were significant differences in the data. The frequency distribution of values confirmed this conclusion. Analysis of significance showed that only the temperature and the pressure-temperature interaction were significant. Trend curves on the effects of temperature and pressure are shown in Figure 5 and indicate that the optimums are at 50 psi. and 250° F. The confidence limits shown in Table 3 indicate that pre-impregnated laminates molded under the optimum conditions cited will have average edgewise compressive strengths of 55,000 pounds per square inch.

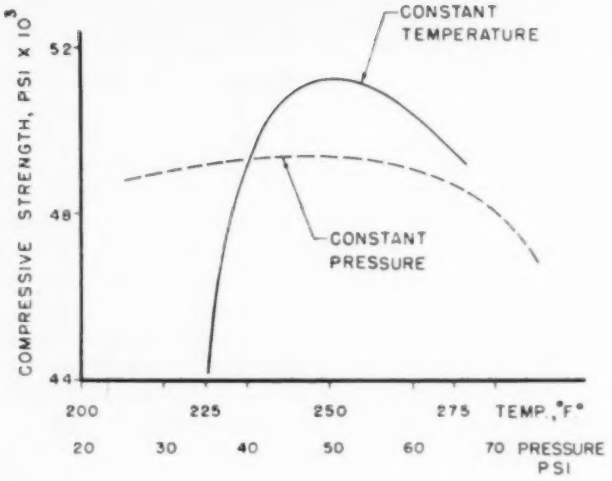


Fig. 5. Effect of molding temperature and pressure on compressive strength of epoxy-glass laminates.

The practical results of these findings are that a temperature of 250° F. produces the correct viscosity in the B-staged resin for optimum molding. Resin flows too freely at temperatures above 250° F., resulting in resin-robbed panels. On the other hand, the formulation is too viscous at temperatures below 250° F., resulting in resin-rich panels.

Pressure is not critical intrinsically, but the significant pressure-temperature interaction would indicate a "squeezing" action due to pressure; if the pressure is too great, the panel will be resin-starved. On the other hand, if the pressure is too low, there will be insufficient compacting and the molding will be resin-rich.

The Soxhlet extraction results for samples molded at 25 psi. and 250° F. at several time intervals, then quenched, showed that complete cure was accomplished in a little less than 15 minutes. "Post extraction" for the 15-minute cure cycle showed that there is an actual weight increase on complete cure, as contrasted to weight loss on incomplete cure.

When these values are plotted, as shown in Figure 6, the S-shaped polymerization curve is revealed. Several intervals are observed in this curve. Interval "A" is the heating time of the aluminum cauls after insertion in the hot press. Only contact pressure is maintained during this interval to avoid crushing the pre-impreg. This value was determined, by means of thermocouples, to be two minutes to rise to press temperature. Interval "B" is the jelling interval. It is during this interval that the pressure-temperature interaction is critical, and pressure should be held at 50 psi. The time of this interval varies with each epoxy and each curing agent, and must be determined for every combination. The gel point, determined by inspection, is that point at which the resin string breaks when pulled out by a sharp probe. As soon as the gelling interval is complete, it is considered desirable to increase the molding pressure in order to take advantage of any consolidation that might be possible, inasmuch as "resin-starving" was found not to occur on pressure increase after this point was reached. Therefore, 150 psi. was chosen arbitarily for the molding pressure used in this interval during all subsequent panel molding, inasmuch as 150 psi. is the usual design pressure for reinforced plastic presses.

The above cycle has been found successful in molding a number of panels over the thickness range ⅛-½ inch, and good thickness tolerance and quality of panel has resulted uniformly.

Table 2 gives the results of testing post-cured panels for edgewise compressive strength. Owing to the complexity of this tabulation, a word of explanation is in order. The three vacuum-molded test panels that yielded the test specimens are identified as sheets 1, 2 and 3. Test coupons were subjected to either one or two post-cure steps that are described as sequences 1 and 2 in the first column of the table. The second column gives the post-cure temperature of that particular sequence step concerned. The scatter of data over the Table is the result of randomization of the experiment by means of tables of random numbers. An example is given on the Table of the system employed, using the asterisked data in the seventh column, fourth row from the bottom. The compressive results obtained, 50,000 and 41,700 psi., were obtained by testing samples taken from sheet No. 2 post-cured for two hours, as indicated by the column heading. The 50,000-psi. value was obtained by post-curing for two hours at 400° F. The 41,700-psi. value was obtained by post-curing for two hours at 400° F., followed by two hours at 300° F., as shown in the temperature and sequence columns.

These data, plotted in Figure 7, indicate that there is little difference in the properties obtained in a single- or double-stage cure, and that the optimum cure temperature is a little above 300° F. The effect of post-cure

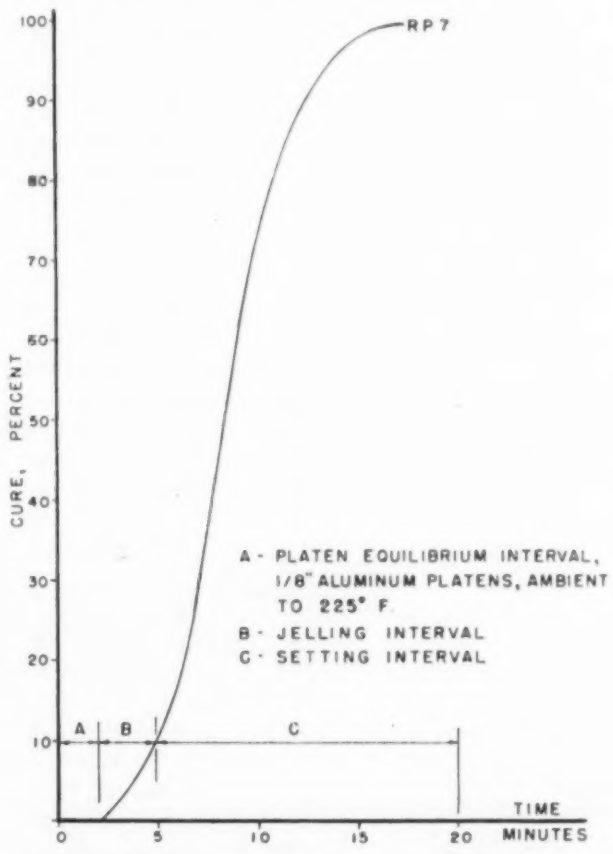


Fig. 6. Polymerization curve for epoxy-glass laminates.

Table 2. Effect of Post-Curing Cycles on Compressive Strengths of Epoxy-Glass Laminates.

Cure Sequence	Cure Temp., °F.	Edgewise Compressive Strength, Psi. — One Hour Cure Time Sheet #1	Sheet #2	Sheet #3	Two Hours Cure Time Sheet #1	Sheet #2	Sheet #3	Three Hours Cure Time Sheet #1	Sheet #2	Sheet #3
1	100	26,500	50,300	.....	28,000	.....	43,500	33,400	59,600	39,200
2	Amb.	33,700	.....	.....	34,200	.....	.....	.....	.....	.....
1	100	32,100	54,700	40,500	55,500	49,500	48,500	25,100	48,200	43,200
2	100	.....	.....	.....	.....	.....	.....	.....	.....	.....
1	100	.....	.....	53,900	.....	50,000	.....	.....	45,100	.....
2	200	44,900	.....	50,500	.....	46,000	.....	.....	39,100	.....
						50,600			53,900	
1	100	.....	61,300	45,600	30,700	.....	58,900	62,200	56,400	.....
2	300	.....	.....	47,100	59,500	.....	.....	.....	47,400	.....
1	100	60,200	48,600	59,200	49,600	59,300	.....	35,000	57,500	.....
2	400	.....	.....	.....	.....	48,400	.....	62,400	.....	.....
1	200	.....	.....	44,800	53,600	50,800	56,300	54,600	.....	.....
2	Amb.	55,900	.....	46,700	.....	.....	.....	32,900	.....	.....
								48,100		
1	200	45,000	.....	57,500	51,400	54,500	49,900	41,500	.....	46,400
2	100	.....	.....	42,700	.....	.....	.....	.....	.....	52,600
1	200	49,700	.....	53,800	.....	53,600	53,300	.....	49,500	51,900
2	200	48,200	.....	.....	.....	.....	42,500	.....	40,800	.....
1	200	67,200	49,900	.....	60,000	.....	49,000	51,500	47,900	.....
2	300	.....	53,400	.....	50,700	.....	.....	.....	51,300	.....
1	200	.....	.....	57,200	50,400	.....	.....	.....	56,000	.....
2	400	.....	60,000	53,900	49,300	53,600	.....	.....	43,200	.....
									65,100	
1	300	57,800	.....	56,100	.....	.....	52,900	.....	.....	53,400
2	Amb.	.....	.....	45,100	51,800	.....	52,500	.....	54,100	53,200
1	300	46,200	48,400	57,800	.....	43,900	.....	.....	51,800	.....
2	100	.....	.....	.....	.....	57,900	53,300	58,200	48,200	.....
1	300	48,400	61,800	.....	58,700	.....	44,000	.....	48,900	54,700
2	200	44,100	.....	.....	50,500	.....	.....	.....	.....	58,400
1	300	61,800	.....	.....	.....	57,500	.....	.....	.....	41,700
2	300	53,500	.....	.....	54,300	46,200	.....	.....	54,900	56,700
		54,700								
1	300	.....	56,200	.....	.....	.....	57,100	64,900	42,800	.....
2	400	.....	48,600	.....	48,600	.....	52,900	60,800	.....	.....
1	400	69,200	.....	55,500	.....	57,000	41,200	54,900	.....	59,100
2	Amb.	.....	.....	53,700	.....	.....	46,900	43,500	.....	.....
1	400	.....	54,900	50,200	.....	.....	55,100	63,000	.....	.....
2	100	.....	49,700	.....	.....	.....	47,700	49,100	60,000	.....
							51,100			
1	400	66,500	.....	46,100	.....	49,800	48,700	62,800	51,600	56,500
2	200	46,300	.....	.....	.....	.....	50,200	.....	.....	.....
1	400	53,400	.....	49,100	48,200	50,000*	.....	53,700	60,800	.....
2	300	.....	.....	53,900	.....	41,700*	.....	47,200	.....	.....
1	400	.....	57,700	52,800	.....	48,800	.....	.....	.....	41,500
2	400	.....	.....	58,800	.....	45,600	.....	60,200	.....	52,000
						51,500				
	Sum	1065.3×10^3	809.7×10^3	1232.4×10^3	885.6×10^3	1066.2×10^3	1054.9×10^3	1065.0×10^3	1233.6×10^3	760.5×10^3
Grand Sum			3107.4×10^3		3006.7×10^3			3059.1×10^3		

*Two samples were heat treated, each for two hours: the first at 400°F. only; the second for two hours at 400° F., followed by two hours at 300° F. Both were cut from sheet No. 2, and gave compressive properties of 50,000 and 41,700 psi., respectively.

Table 3. Confidence Limits for Press-Molded Epoxy-Glass Laminates.*

Molding Temperature, °F.	Number of Cases	Average Edgewise Compressive Strength, Psi.	Standard Deviation, psi.	Compressive Strength, Psi., 85% Limits — Individual High	Individual Low	Average High	Average Low
225±10	9	44,100	7,800	60,000	29,000	49,700	38,500
250±10	9	51,400	5,000	60,000	40,000	55,000	47,800
275±10	9	49,600	4,700	59,000	40,000	52,900	46,300

*No post-curing used.

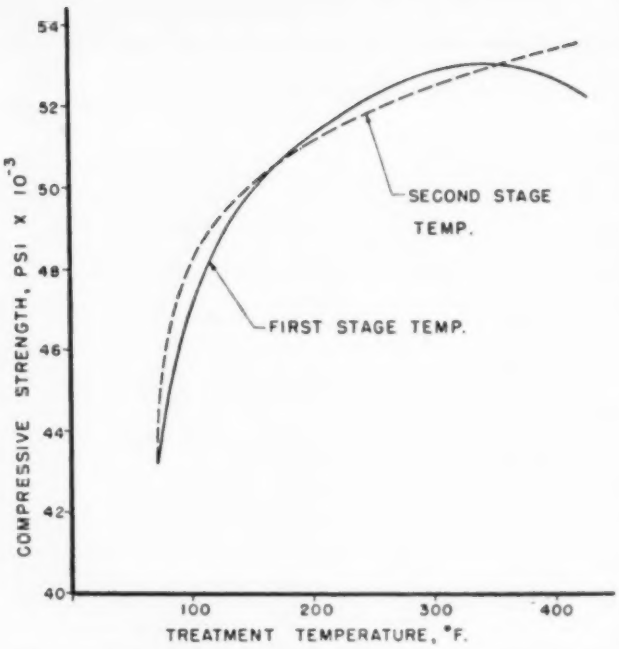


Fig. 7. Effect on post-cure treatment on compressive strengths of epoxy-glass laminates (see Table 2).

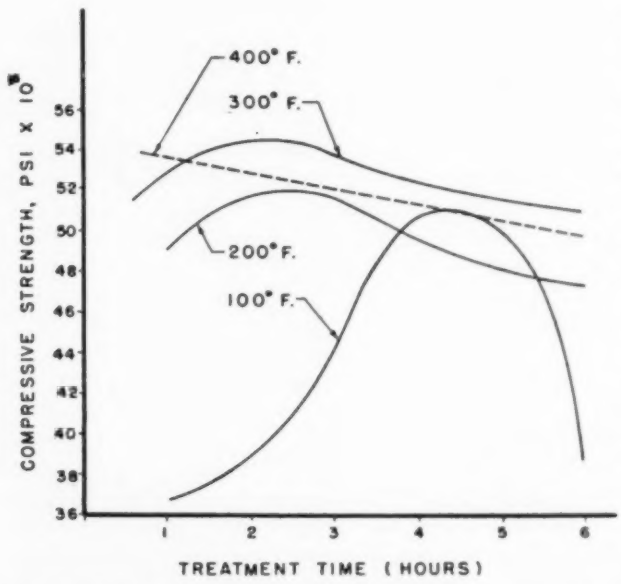


Fig. 8. Effect of post-cure treatment time on compressive strengths of epoxy-glass laminates (see Table 2).

time on edgewise compressive strength is shown in Figure 8. From this it may be seen that the optimum time is two hours, and the optimum temperature is 300° F.

Analysis of variance shows that only the post-cure temperature is truly significant. Further, it is significant at the 1% level, meaning that there is only one chance in a hundred that temperature is not significant.

Test panels, made according to the optimum procedure revealed by this study, were subjected to a series of physical and electrical tests, and the data obtained are shown in Table 5, on the facing page. The values obtained agreed well with those published by the raw material manufacturers.

Conclusions

Average edgewise-compressive strengths of 48,000 psi., with tangent compressive modulus of 3.8-million psi., can be achieved consistently by press molding preimpregnated, B-staged, glass cloth-reinforced epoxy laminates. These values can be obtained using conventional laminating equipment and molding at 250° F. and 50 psi. Such values are achieved after post-curing, which raises structural values about 20%. The optimum conditions for post-curing are two hours at 300° F.

Bibliography

(1). "Test Methods for Structural Plastics Laminates at Low Temperatures and Elevated Temperatures", ATC Report No. ARTC-11, Aircraft Industries Assoc., Washington 5, D.C. (June 1956).
(2). "Bakelite C-8 Epoxy Resin ERL 2774," Bulletin J-818, Bakelite Co. New York, N. Y. (Oct. 1954).
(3). "Bakelite C-8 Epoxy Resins and Hardeners", Bulletin J-884, Bakelite Co., New York, N. Y. (May 1955).
(4). "Curing Agent CL in Casting and Laminating", Bulletin SC 55-57, Shell Chemical Co., New York, N. Y. (Oct. 1955).
(5). Damusis, Adolph, "Amines as Curing Agents of Ether Resins", Div. of Paint, Plastics & Printing Ink Chemistry, American Chemical Society, 16, 2 (Sept. 1956).
(6). "Epi-Rez 510", bulletin of Jones Dabney Co., Louisville, Ky. (Dec. 12, 1955).
(7). "Epon Resins for Laminating," Bulletin SC 56-18, Shell Chemical Co. (March 1956).
(8). "Epoxy Hardeners", Dion Data Leaflet 302, Chemical Process Co., Redwood City, Calif. (June 1956).
(9). Lively, Guy, "Epoxy Laminating: Production Problems and Techniques", Douglas Aircraft Co., Inc., Santa Monica, Calif. (Dec. 1956).
(10). Polymer Progress, published by Shell Chemical Co. (Oct. 1955).
(11). "Recommendations for Handling Amine-Cured Epon Resins," Bulletin SC 55-27, Shell Chemical Co. (July 1955).
(12). Philipson, Joseph, "Liquid Amine Hardeners for High Temperature Epoxy Resins," Paper presented at the Symposium on Epoxy Resins, Southern California Section, SPE (Nov. 16, 1956).

Table 4. Polymerization-Rate Data On Press-Molded Epoxy-Glass Laminates.*

Cure Time, Min.	Initial Sample Weight, Gms.	Post-Extraction Weight, Gms.	Post-Burnout Weight, Gms.	Percent Polymerized
3	6.0568	4.2356	4.1792	3.1
5	5.4217	4.0597	3.9036	10.3
10	5.7428	5.3896	4.3071	75.4
12	5.9137	5.7993	4.4944	88.4
15	6.1492	6.1924	4.5504	100.

*Press-molded at 225° F. and 25 psi. (See Fig. 6).

Table 5. Some Properties of Press-Molded, Post- Cured, Pre-impregnated Epoxy-Glass Laminates.

	Average	Minimum	Maximum
Arc resistance, sec.	361	361	362
Dielectric constant, dry		4.69	4.86
Strength, volts/mil	509	493	537
Loss tangent, dry		0.013	0.015
Edgewise Compressive Strength:			
Warp direction, psi.	54,090	48,880	59,890
Fill direction, psi.	52,450	47,130	55,940
Edgewise Compressive Modulus:			
Warp direction, $x10^6$ psi.	3.915	3.822	4.028
Fill direction, $x10^6$ psi..	3.585	3.394	3.759
Tensile Strength, psi:			
Warp direction	50,000	49,010	50,900
Fill direction	47,040	45,300	48,720
Tensile Modulus, psi. x 10^6:			
Warp direction	3.036	2.943	3.145
Fill direction	3.040	3.015	3.068
Tensile Strength at 400° F., psi.:			
Warp direction	22,910	22,090	23,890
Fill direction	22,430	21,440	24,360
Flexural Strength, psi.:			
Warp direction	74,560	73,160	75,950
Flexural Modulus, psi. $x10^6$:			
Warp direction	2.582	2.40	2.762

—THE END

Early Detection of Weathering Damage in Polyethylene
(Con't from page 432)

weathering damage for exposure times greater than 14 months outdoors, but underwent stress-cracking and severe loss of tensile properties after longer exposure times.

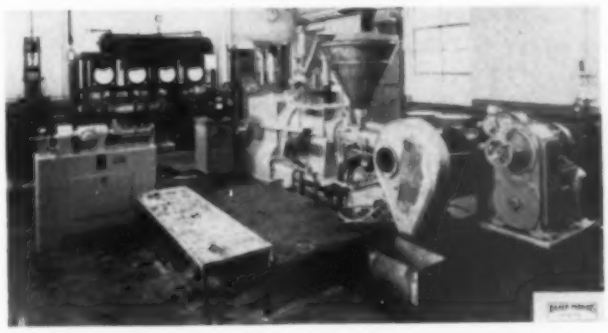
Acknowledgment

The authors would like to acknowledge the important contributions of G. M. Armstrong and J. H. Chaudet, of our Laboratories, to this work.

References

(1). B. S. Biggs, "Polymer Degradation Mechanisms," National Bureau of Standards Circular 525, p. 137 (1953).
(2). V. T. Wallder, W. J. Clarke, J. B. DeCoste, and J. B. Howard, **Ind. Eng. Chem.**, 42, 2320 (1950).
(3). A. R. Burgess, "Polymer Degradation Mechanisms," National Bureau of Standards Circular 525 (1953), p. 149.
(4). M. F. Gribbins (to E. I. du Pont de Nemours and Co., Inc.), U. S. Patent 2,519,755 (1955).
(5). J. R. Vincent (to E. I. du Pont de Nemours and Co. Inc.), U. S. Patent 2,727,879 (1955).
(6). G. C. DeCroes and J. W. Tamblyn, **Modern Plastics**, 29, 8, 127 (April 1952).
(7). J. W. Tamblyn and G. M. Armstrong, **Anal. Chem.** 25, 460 (1953).
(8). F. M. Rugg, J. J. Smith, and R. C. Bacon, **J. Polymer Sci.**, 13, 535 (1954).
(9). L. H. Cross, R. B. Richards, and H. A. Willis, **Disc. Faraday Soc.**, No. 9. 235 (1950)
(10). G. S. Forbes and L. J. Heidt, **J. Am. Chem. Soc.**, 56, 2363 (1934); W. G. Leighton and G. S. Forbes, **Ibid.**, 52, 3139 (1930).
(11). J. J. Gouza and W. F. Bartoe, **Modern Plastics**, 33, 9, 157 (May 1956).
(12). L. D. Moore, Jr., **J. Poylmer Sci.**, 20, 137 (1956).
(13). A. W. Pross and R. M. Black, **J. Soc. Chem. Ind.**, 69, 113 (1950).
(14). C. S. Myers, **Ind. Eng. Chem.**, 44, 1095 (1952).
(15). R. B. Barrett, Technical Report 2102, Ordnance Project TB4-721A, Dept. of Army Project 593-13-004, Picatinny Arsenal (1955).
(16). G. Kavafian, **J. Polymer Sci.**, 24, 499 (1957).
(17). T. Garcia-Borras and J. V. Cavender, **Ibid.**, 24, 138 (1957).
(18). F. C. Sutro, Jr., "Medium-Density Polyethylenes" paper presented at the SPE Cleveland-Akron Regional Technical Conference, Cleveland, O., Oct. 17, 1957.
(19). A. R. Burgess (to Imperial Chemical Industries Ltd.), British Patent 677,733 (1952); U. S. Patent 2,615,860 (1952).
(20). H. W. Thompson, R. W. Needham, and D. Jameson, **Spectrochim. Acta**, 9, 208 (1957).

—THE END



Baker Perkins' continuous KO-Kneader is being used to replace batch mixers in preparing polyester premixes for auto heater housings and mixing carbon electrodes for aluminum reduction furnaces. The new installation is expected to provide higher quality and production in less floor space.

—THE END

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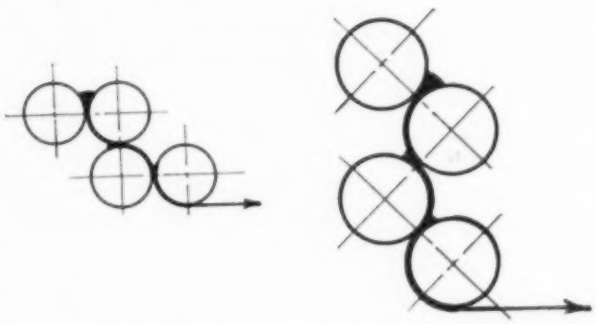
Developments in Plastic Film and Sheeting Processing During 1957

IMPORTANT advances were made in vinyl film sheeting during 1957. These are particularly significant because these materials must be regarded as matured members in the family of plastics.

Among equipment improvements, a calender of a new design, referred to as "Inclined-Z," (see illustration) first saw commercial usage in 1957. In this design, the basic advantages of the standard "Z"-type calender, which permits free roll deflection, has been maintained. In addition, however, the "Inclined-Z" calender presents an accessibility that was not obtainable in earlier models. This arrangement of rolls provides a clear, short path for material travel, ease of threading, and adequate space for embossing or other auxiliary equipment. When combined with crossed-axes for improved gage control and a high temperature heating medium, this machine has a flexibility previously denied the plastics sheeting industry. High molecular-weight resins possessing many promising physical properties, such as vinyls, high-density polyethylene, polypropylene, etc., now can be calendered by the utilization of these higher temperatures.

Another significant processing advance was made in the field of decorative quilting. A dielectrically-sealed inlay or decal made a major contribution to 1957 automotive interior styling improvements. In this process, a decorative vinyl film is sealed dielectrically to heavy gage supported-base fabric with a tear seal die. When excess film trim is pulled away from the quilted item, a trimmed decorative inlay remains sealed to the base material. The furniture industry is making use of the same process in the manufacture of elaborately quilted headboards, chair backs, etc.



Schematic view of standard-Z (left) and inclined-Z (right) calenders.

The development of optimum sealing uniformity in customers' plants challenged the capabilities of chemists, engineers, and electronic specialists. Exhaustive studies were demanded of the dielectric behavior and variables of every sheeting component, including the polyvinyl chloride resin-plasticizer-stabilizer systems, pigments, metallics, lubricants, backings and their saturants, adhesives, etc. Highlighted was the need for basic knowledge of the effect of molecular weight and molecular-weight distribution of PVC, and the varying actions of single plasticizers or plasticizer systems on the flow and sealing properties of the finished formulation. The type and thickness of the top coating, the residual solvents, printing inks, etc., were found to contribute significantly to sealing behavior. Critical physical specification requirements of the end-product, of course, could not be sacrificed for ease of sealing.

Perhaps the largest number of product developments

in 1957 resulted from improvements in the combining processes. New adhesives and techniques permitted a fortuitous wedding of polyester and vinyl base sheet, giving improved abrasion and chemical resistance in combination with a decorative effect to produce materials that are ideally suited for heavy-duty interior surfacing; i.e., buses, trains, domestic and institutional counter-tops, etc.

Other process developments have permitted vinyl to be laminated to metal to produce a pressure-formable sheet finding many applications in the automotive, office furniture, electronics, and many other industries.

New combining procedures have made possible the production of new fabric-backed vinyl wall coverings exhibiting the handling ease and hanging properties of high grade wall-papers. This new decorator material is commanding a portion of the market previously held by the more difficult to install heavy-gage vinyl wall coverings and, also, is replacing the more expensive soil resistant-type of wall-papers.

The combination of woven nylon scrim and vinyl film established a firm position in the areas previously served by canvas and duck fabrics. Strong, waterproof, lightweight paulins, truck and aircraft covers, out-door furniture covers, and protective enclosures of all types are items produced from this new fabric. Additional applications are found in beach goods, mattresses and life preservers. Heavier weight materials are used to fabricate compressed air-supported warehouses and portable airplane hangars, as well as portable ice-skating rinks. Many agricultural uses, such as temporary water tanks and several types of silos, are firmly established. In military applications, aircraft and artillery covers, as well as the much publicized "raincoats for Corporals," have made use of the unique properties of the vinyl-nylon sandwich. These missile coverings, many more than 45-feet long and having plastic zippers (allowing instantaneous removal from a ready-to-fire rocket), weigh not more than 50 pounds.

Several new types of clothing have been manufactured from unsupported vinyl film. These include gas-tight suits, radio-active fall-out, water ski suits, fisherman's waders, and bright yellow wind-breakers for hunting. Significant yardages of film found ready use as greenhouse glazing in 1957. Zippered cases for guns and radio equipment are used currently to keep this essential equipment free from sea damage during amphibious landings. In mentioning the many uses for unsupported film that developed during this period, one must not overlook pressure-sensitive wall coverings that currently are enjoying a large retail sale.

The potential large-sheeting markets developed in 1957 center around the automotive industry and the building trades. Clear automotive seat covers enjoyed a large market in the past year, and are expected to find increasing use in the future.

A major contribution to the fireproofing of buildings will be established firmly in coming years as vinyl sheeting finds increased usage as a fungus-resistant, water-proof roofing material supplanting combustible tar paper and felts in this application.

Epoxy-Coated Phenolic Camera Parts

A tough, epoxy-based enamel is being used by Eastman Kodak to coat the phenolic interiors of its Dignet 40 camera. Rexclad R, a product of Rexton Finishes, Inc., Irvington, N. J., gives a dull finish whose scanning incidence gloss is zero. Its black, non-reflective finish absorbs virtually all stray light rays which could impair the film.

Kodak Signet 40.

The coating is a two-component system based on an Epon resin manufactured by Shell Chemical Corp. Resin and hardener is mixed just prior to application, and pot life is about 36 hours. After spraying, the enamel is air-dried for two hours; force-dried at 140° F. for 10 minutes; or baked for one hour at 250° F. Choice of curing schedule generally is dictated by production line requirements; however, the above temperatures are not sufficiently high to distort the phenolic parts.

Adhesion is excellent, even to the highest gloss phenolics; and a single coating replaces the two-step operation of primer and lacquer. According to Kodak engineers, the epoxy enamel provides the required interior finish without sandblasting the phenolic interior.

—THE END

Camera interior is sprayed with epoxy finish to eliminate reflectivity.

Edited by:
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Moldmaking & Tooling

Moldmakers and their Price Quotations

THE past November issue of this column discussed the matter of mold costs as an explanation of the factors of mold construction contributing to the ultimate price. The text of that article was, in the main, directed to the mold user, rather than the moldmaker.

Now, let us consider the other side of the picture. In many cases, the ultimate cost of a mold is as much of a surprise to the moldmaker as the quoted price was to his customer. If the quoted price does not agree with the actual cost of manufacture, we certainly must consider that one of the two was incorrect. It is even possible that both figures could have been wrong, because not all cost systems are accurate enough to yield the true result. As a matter of fact, many moldmaking shops operate without any formal system of knowing their actual cost picture. It is to those shops that this article mainly is directed.

A number of times, I have heard a moldmaker say, "Sure I lose money on some jobs, but I make more on others and all I want is to be in the black at the end of the year." This type of thinking, based on the fallacy that two wrongs make a right, can lead to a distorted attitude towards price quoting. Especially at times like the present, with competition at a peak, the need of getting jobs must be tempered by a thorough knowledge of costs. Low bids, based merely on the need for securing work, are not the answer to the problem. As a matter of fact, this type of activity can be very well the road to financial disaster.

The main point I would like to make is summed up in the following sentences. Factors that affect costs must be considered in all our estimating and, thus, are reflected in the quoted price. If the estimator of a mold does not have at his disposal the results of a cost picture in his particular plant, a good part of his estimating is based on an educated guess. He may be perfectly correct in the number of hours needed to do the job, and his shop actually may perform to the same number of work hours. The quoted price, however, was a product of the number of work-hours and the cost per hour of doing business. If the cost per hour was not accurate for his plant, his quoted price was incorrect.

What does cost consist of? First, we have direct labor, material, and other outside purchases. To these basic costs, we must apply overhead costs that vary from plant to plant and, all too often, are either overlooked or incorrectly applied by the small manufacturer. As an example, I should like to list a number of these items of overhead cost that have to be apportioned properly to the hourly rate of doing business on each specific and different shop activity:

(1). Depreciation of buildings.
(2). Depreciation of machinery and equipment.
(3). Insurance premiums.
(4). Janitor service.
(5). Indirect labor.
(6). Supplies.
(7). Rents.
(8). Power and light.
(9). Unemployment and old age survivors insurance.
(10). Stock room.
(11). Taxes on building.
(12). Taxes on machinery and equipment.
(13). Small tools.
(14). Repairs.
(15). Superintendence.

The above, of course, is not limited to moldmakers. Good and accurate business practices are in order in all types of manufacturing. It is just that moldmaking shops, in many cases, are smaller than other similar activities, and a good number of these shops are being operated without formal cost systems.

Since estimating brings in the business, and the very existence of a company is based on the yield from the work it performs, it is of the utmost importance that its estimates or quotations be correct. There is no better way of knowing what to quote, than to first know what will it cost.

—THE END

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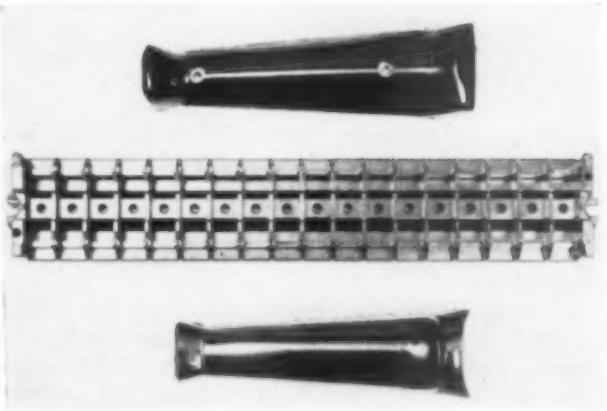
Compression & Transfer Molding

TRANSFER molding is expensive. Even if automated, it is expensive. We, as manufacturers of automatic molding machines, are proving time and time again to customers and prospective customers that redesign to compression is sound, even with the purchase of new molds and new automatic compression equipment. Years ago, everything went to transfer. At that time, it was considered the way to mold. Today, more and more are going automatic compression; it is the economical way to mold thermosets. With transfer, heavy tonnages are required, a great amount of material is wasted in runners and cull, labor is high and, in most cases, pre-forms are used. These result in a control point, a contamination point, an inventory problem, and an expensive item.

It is true, all transfer parts cannot be compression molded. However, with a little thought, a little initiative, and persistence, a great deal can be accomplished. Many insert jobs can be after-operations or eliminated; some delicate sections can be strengthened; some heavy sections can be cored; some parts can be designed to have the strength only where such strength is required, and not all over.

One excellent recent example of thorough thought and persistence is the illustrated fry pan handle. This part was formerly transfer molded like thousands of appliance handles everywhere; and it was expensive. This part was redesigned for automatic compression molding, new molds and new automatic presses were purchased, and costs were reduced substantially.



To the best of our knowledge, this is the first appliance handle molding job ever operated automatically.

Another outstanding example of designing for automatics and for subsequent cost savings is the 12-inch terminal strip (also shown in the illustration) that now is molded automatically.

The point is that old methods must be discarded; new automatic equipment has to be operated; and, if necessary, parts must be redesigned for operation on this type of equipment. Costs must be reduced, but taxes and wages are difficult to alter. The answer lies in redesign and compression automatics.

*This column replaces John H. Woodruff's Forum this month.

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Reinforced Plastics

Growing Future for Reinforced Plastics in Consumer Boats

ONE of the fields in which reinforced plastics has shown the most remarkable growth is in small boats. In 1957, nearly $2-billion were spent by boat buyers. Approximately 15% of this total was spent on reinforced plastic boats, marking a 20% growth over the previous year.

Naturally, there are good reasons why the public has taken to boating in constantly-increasing numbers. Among these reasons are the continual downward trend in boat prices; the unhappy fact that our congested highways no longer offer care-free pleasure driving; and the increasing number of well-equipped marinas providing all manner of attractive facilities. Boating has been discovered as a source of pleasant recreation in which members of the entire family can indulge; such as fishing, swimming, water skiing, skin diving, or just plain sight-seeing.

Reinforced plastics as a material for pleasure boats is being utilized on an increasing scale. Here, too, there are sound reasons for its selection; many of the new boat owners and increasing numbers of "old salts" appreciate the lack of maintenance and the lasting qualities of boats made of this light-weight, tremendously strong material.

The experienced reinforced plastics molder seeking new outlets for his manufacturing talents would do well to consider this growing market. There seems to be enough potential in this field for reputable plastic molders to add considerably to their volume. The public, of course, will become more discriminating with each passing year, and only high-quality, uniform products will be successful in the long run.

To undertake the manufacture of a line of boats involves a considerable expense. Designs, patterns, molds, jigs and fixtures, necessitate a high capital outlay. This is magnified by the number of different models possible, to say nothing of filling the pipeline with a supply of high-cost materials such as hardware, windshield assemblies, and other components.

There is considerable cost to be encountered in developing means of transport, and a proper dealer organization that must be serviced and supplied with aids such as posters, brochures, and sales literature of all types. Very soon, the questions must be faced as to whether the boats will be stocked in slack selling seasons; how to handle the tricky question of dealer discounts; and the ever-present problem of credit.

With all of the problems, here is an interesting and challenging field that offers every possibility for success if approached prudently.

—THE END

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News of the Societies

SPI Pacific Coast Conference

A total of 730 members and guests gathered at the El Mirador Hotel, Palm Springs, Calif., to attend the 15th Annual Conference of the Pacific Coast Section, Society of the Plastics Industry, Inc. The three-day conclave, which began March 26, was launched by a business meeting during which officers for the 1958-59 term were elected. Included in the group who will guide the section's affairs during the current year are: chairman, John L. Stieff, Coast Mfg. & Supply Co.; secretary, James H. Watt, Monsanto Chemical Co.; vice-chairman, John Del Monte, Furane Plastics, Inc.; and treasurer, William S. Rhodes, Mercury Plastics, Inc.

The following two days were devoted to a variety of technical sessions. Luncheon on the 26th featured a guest speaker, the Honorable Frederick H. Mueller, Assistant Secretary of Commerce, who pointed up the brighter aspects of our current economic situation, and explained what administration officials are doing to alleviate the down-turn.

A joint session on "Progress in Plastic Pipe," was moderated by William L. Hess, Anecite Corp. Participants in the panel included Raymond B. Seymour, Loven Chemical of California, and W. Sidney Aitken, Marken Plastics Corp. The lectures and subsequent discussions revealed that commercial acceptance of plastic piping is reflected in the growth of its market from $500,000 in 1948 to $50-million in 1957, with an expected 10% increase during the current year. Research programs, development of commercial standards, and technological advancement have generated a growing confidence in this phase of the plastics industry.

Ernest C. Bernhardt, E. I. du Pont de Nemours & Co., reviewed "Progress in Extrusion." Beginning with the screw-pump principle attributed to Archimedes, he traced the development of extruders through to the present-day automated designs. Early industrial machines used in the 1930's were designed almost entirely on the basis of empirically derived data. Complex studies of the last decade however, have narrowed previously unmeasurable factors down to a point where extruder performance can be mathematically calculated. Today extrusion as a form of polymer processing has gained recognition as a science.

J. A. Morton, Extruders, Inc., spoke on "Industrial Packaging with Polyethylene Film," relating several case histories where this material has shown a performance superior to that of acetate butyrate and vinyl.

Two approaches to the manufacture and application of "High Density Polyethylene," were discussed in a panel session moderated by Lloyd A. Johnson, Jet Specialties Co. Dr. R. Jones, Phillips Petroleum Co., outlined the physical properties of the product made by the Phillips process; discussed its behaviour during molding operations; and described several of the resultant end-products. W. O. Bracken, Hercules Powder Co., discussed Hi-Fax and Pro-Fax. The former is a high density polyethylene made under a Ziegler license, while the latter is a polypropylene.

Entitled "Radiation: Plastics New Tool," the paper presented by Dr. W. C. Goggin, Dow Chemical Co., discussed the various forms and effects of radiation, and pointed out that their application to plastics materials can result in decomposition, vulcanization, molecular cross-linkage; polymerization, and graft-copolymerization.

SPE New York Section

Members of SPE's New York section, together with the reinforced plastics and thermoforming sub-groups, gathered for their monthly meeting, March 19, at the Governor Clinton Hotel, New York, N. Y. Following dinner, the various groups repaired to separate conference rooms for the completion of the evening's program. Topic for the main meeting was linear polyethylene, its properties, development, processability, and applications.

Lead-off speaker, addressing the main group, was David Jones, Celanese Corp. of America, who spoke on "Molding of 0.96 Density Linear Polyethylene." Reviewing the studies conducted by Celanese in this field, Mr. Jones discussed the effect of injection machine variables and gate size on the physical properties and mold shrinkage of these materials. Slides were used to illustrate the characteristics of various melt index resins that had been studied in a spiral flow mold. Physical properties and field molding case studies of high melt index materials were reviewed; and design considerations for parts and molds which permit the processor to take advantage of the properties of linear polyethylene were discussed.

Peter D. Monti, also of Celanese, delivered a paper on "The Techniques of Extruding Linear Polyethylene." He discussed some of the desirable features which should be incorporated in the screw and dies; and used slides to illustrate some of the techniques developed for sheet and tubular section extrusions, and extrusion coatings. Also discussed were some of the fundamental phenomena occurring in the polymer during extrusion and subsequent quench.

"Designing With Reinforced Plastics" was the topic brought into focus by Charles L. Condit, Society of the Plastics Industry, Inc., who addressed the reinforced plastics sub-group. Using a strip, color film, depicting the development of the industry, Mr. Condit reviewed nine major markets for reinforced plastics and high-lighted the sectors where substantial increases in the use of these materials are anticipated.

David F. Anderson, Rand Development Corp., spoke on "The Simultaneous Deposition of Fiberglass and Resin" which is a recently developed technique that is expected to replace existing hand lay-up methods. It involves the simultaneous cutting of roving into strands of desired length; separating them; and spraying them, together with a predetermined amount of resin, directly onto the mold form. According to reports, this method promises to be the cheapest way to make large parts.

Kenneth Henry, Celanese Corp. of America, presented a paper on "Thermoforming of Cellulose Acetate and Linear Polyethylene." He outlined the growth of acetate in blister packaging, how it happened, and what it means to formers.

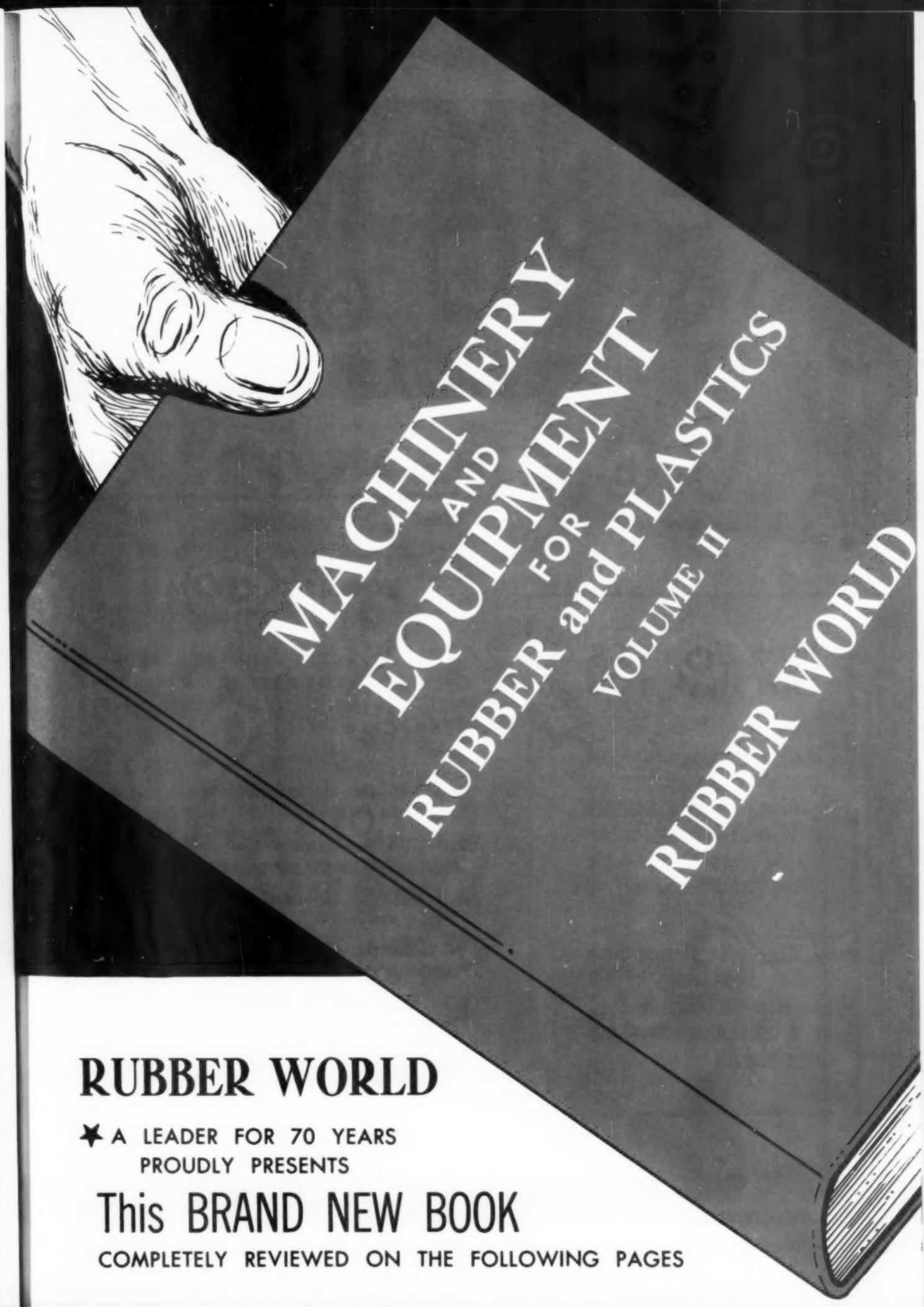
SPE Newark Section

Recent developments in injection molding and extrusion were discussed at the March 12 meeting of the Newark Section, Society of Plastics Engineers, Inc. The Military Park Hotel in Newark, N. J., was the locale, and both speakers are members of the technical service department, Monsanto Chemical Co.

Ralph E. Hammer considered both materials and equipment used in injection molding. He brought out that 45% of the styrene in use today is of the rubber-modified impact type, and static-dissipating styrenes are finding increased usage. Acrylics are now being used for shoe heels, and the following materials are coming into favor: polycarbonates, Delrin acetal resin, Teflon 100X, and the polypropylenes.

With respect to equipment, machines gaining favor have preplasticizing and conical heat chambers; and use hot runner molds, multiple gating, valve gating, high-speed injection, and telescopic mold closure.

The second speaker, R.D. Sackett, pointed out that the SPE is seeking to increase extrusion theory knowledge and promote agreement on terminology. In the field, there is a growing trend towards vented extrusion, induction heating, and high speed extrusion. Induction heating involves wrapping a coil around the barrel, and using 60-cycle line voltage to generate heat along the lines of magnetic force within the barrel's walls. This method may, in time, be supplanted by high speed extrusion.



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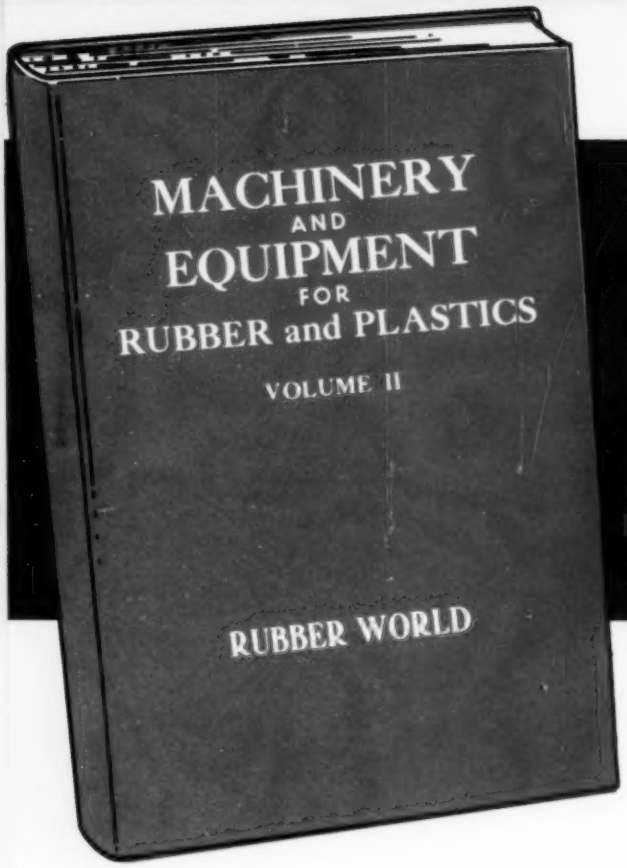

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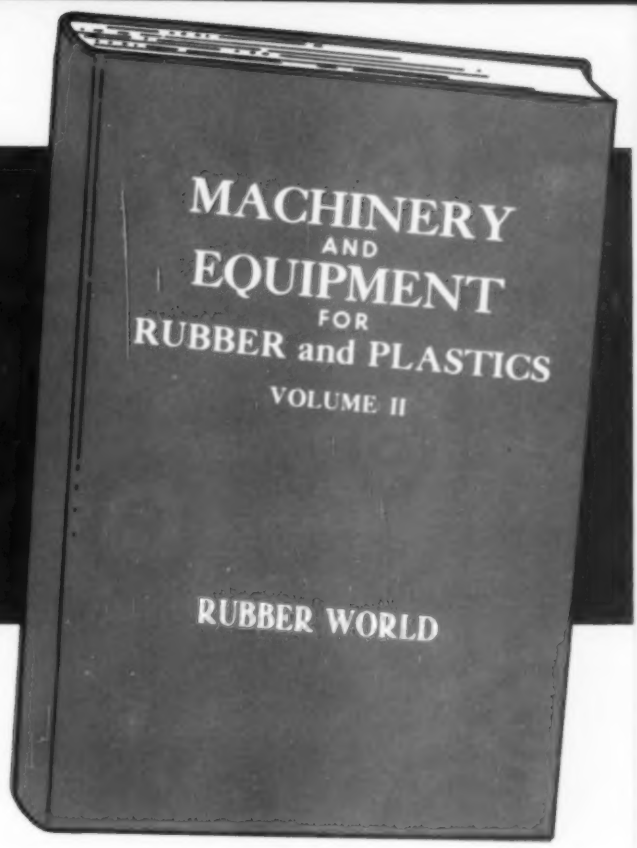

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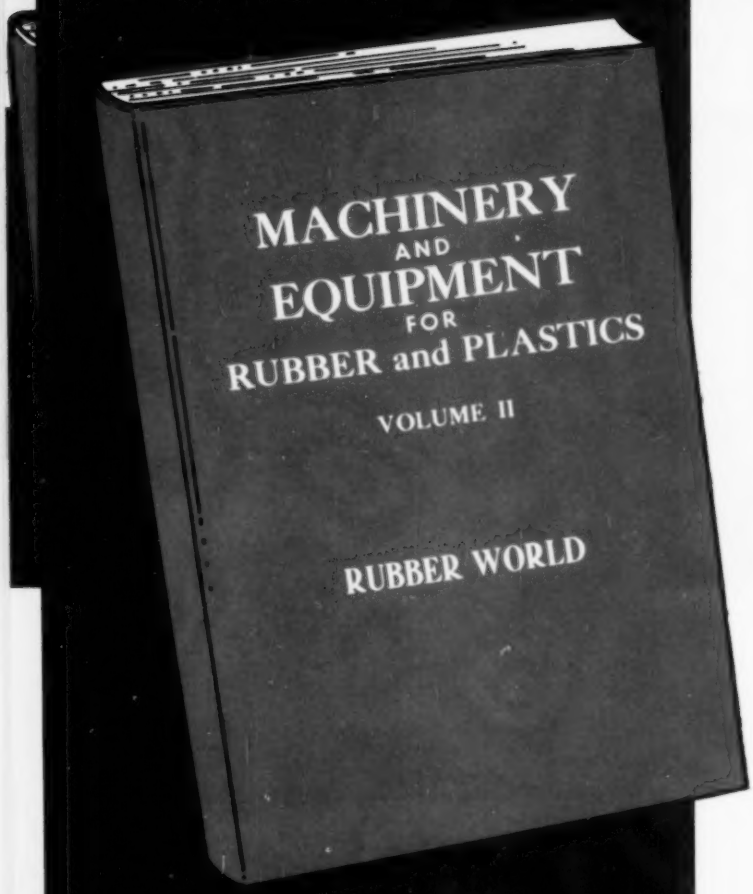

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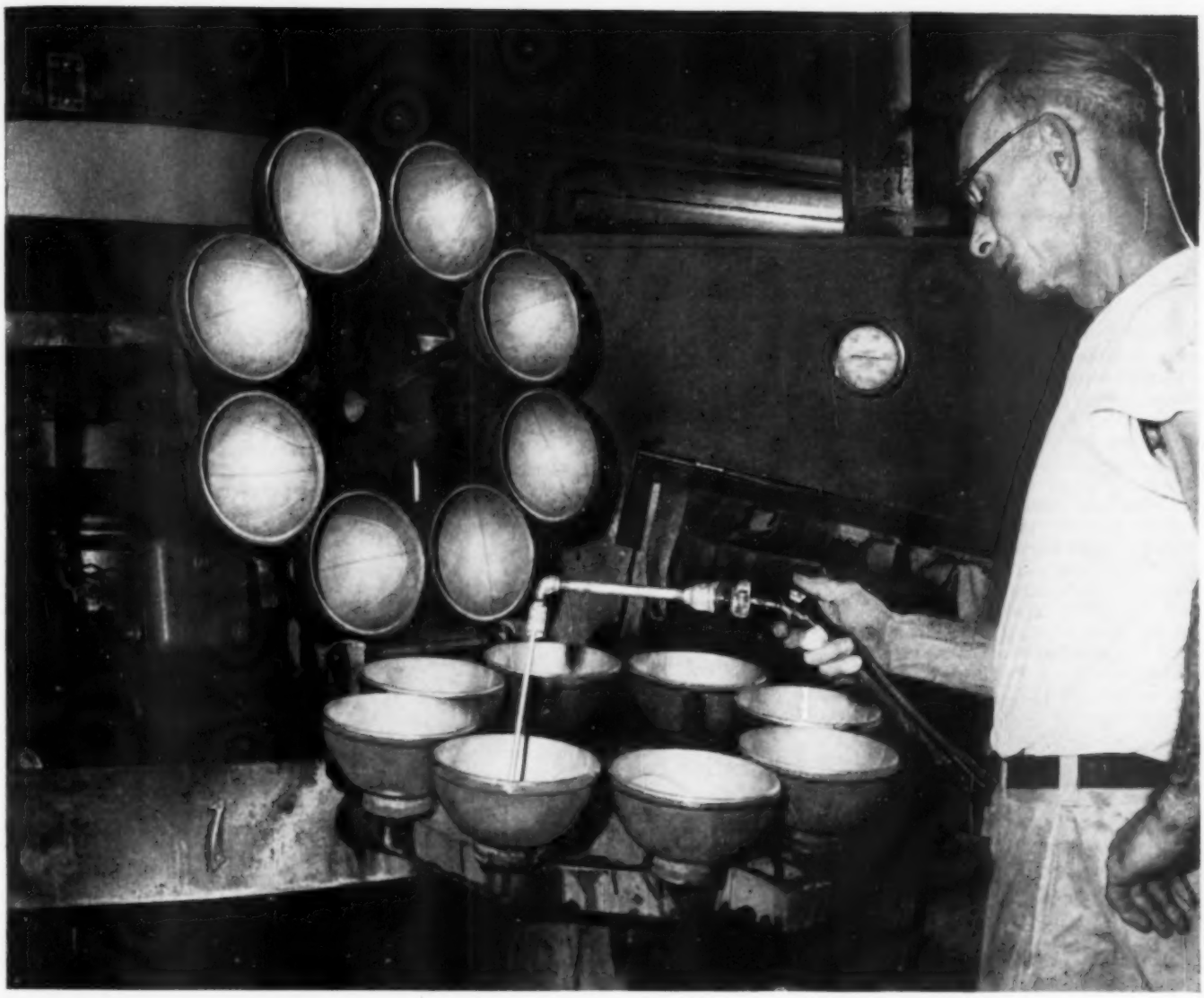

Photo courtesy National Latex Products Company, Ashland, Ohio.

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MONOPLEX S-73

News of the Industry

Polyurethane Foam Sales Boom

A 70% increase in sales for Mobay Chemical Co., a leading supplier of urethane chemicals, was revealed by sales manager J. D. Mahoney in a report to the Commercial Chemical Development Association. "Basic markets for urethane cushioning foams are presently in the automotive and home furnishing fields," he pointed out, "and Mobay's sales gain is a direct confirmation of their acceptance by industry and consumers."

Based on current market acceptance, Mr. Mahoney envisions a 45-million pound potential for urethane foams in 1958. Commercial foams average about two pounds per cubic foot, which means that about 23½-million cubic feet should be produced this year. "More than $500,000 a month currently is being spent on basic research," he added, "to speed up the transition of new urethanes from the laboratory testing stage to the production lines. Application research is underway in such diverse fields as mattresses, industrial packaging, interlining, carpet underlay, and both thermal and acoustical insulation."

Mr. Mahoney further stated ". . . that the 'big breakthrough' for urethane cushioning foams took place at the Chicago furniture market in January, when more than 135 manufacturers displayed furniture pieces with urethane foam in seat cushions, backs, and arm rests." One manufacturer reported that "80% of his orders specified urethane foam as the cushioning material."

Mobay is presently the only domestic supplier of all the component chemicals required for urethane foam production. The firm recently transferred its headquarters from St. Louis to Pittsburgh, so that it would be closer to the main plant in New Martinsville, W. Va.

Offers Quality Control Course

The 15th annual program of "Quality Control for the Chemical Industries" will be held again this summer at Rochester Institute of Technology. The dates are June 23 to July 2; and the program will include a series of conferences, lectures, and laboratory periods lasting from 8:30 a.m. to 5:00 p.m. each day except Sunday. Evening "get-togethers" for discussing mutual problems with the instructors also are scheduled.

This intensive course is devoted exclusively to statistical control problems of the chemical and process industries. It will follow seven general lines: a survey of basic control concepts, concepts and strategies of statistical inference, tests of significance and confidence limits, analysis of variance, simple correlation and linear regression, multiple regression, and experimental design.

A knowledge of elementary algebra is essential. Advanced work in mathematics and previous training in statistics are helpful but not necessary. Tuition for the course is $180, which covers books, supplies, and a room in the Institute's dormitory facilities. Inquiries should be directed to Robert D. Pease, associate director, evening division, Rochester Institute of Technology, Rochester 8, N. Y.

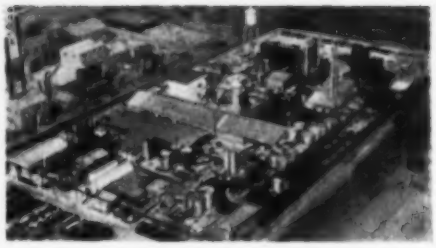
Radiation For Hire

An eight million volt linear accelerator, producing an electron beam equivalent to 140,000 curies of cobalt-60, is available on a rental basis at Midwest Irradiation Center, Rockford, Ill. Designed and built by Applied Radiation Corp., Walnut Creek, Calif., the unit can produce high energy electron beams, X-rays, or neutrons, as desired.

Owned and operated by Applied Radiation Corp., and W. F. and John Barnes Co., Rockford, Ill., the Center was established to provide facilities for industrial and academic groups interested in radiation research. In addition to the accelerator, the Center provides locked storage space for apparatus and materials, and a laboratory where experiments can be set up. The entire installation can be rented for as little as one hour or as much as several days at a cost of $100 per hour.

Opens Plastics Laboratory

A customer service facility for physical and chemical testing, has been placed in operation by Hasting Plastics, Inc., Santa Monica, Calif. The laboratory can be used to run quality control tests for plastics compounds and to assay the characteristics of pilot plant batches of new or special products. In addition to high and low temperature testing equipment, a 20,000 pound universal testing machine is available. Equipment planned for the future includes automatic read-out instrumentation incorporating an analog computer system, and an automatic balance with built-in weights.



Aerial view of Emery's newly-acquired Vopcolene division.

Acquires Fatty Acid Plant

Vegetable Oil Products Co.'s fatty acid-producing Vopcolene division, located at Los Angeles, Calif., has been acquired by Emery Industries, Inc., Cincinnati, O. The transaction became effective April 1, and includes transfer of the division's entire property, production facilities, trademarks, and other assets. No changes in personnel are contemplated, and the operation is continuing under the direction of Carl Williams, general manager.

Relocates Company Offices

Executive offices of Nicolet Industries, Inc., formerly located at 70 Pine St., New York, N. Y., have been moved to a newly erected building at Florham Park, N. J. The 20,000 square-foot structure provides space to accommodate headquarters, research, and development facilities for Nicolet's component companies which include: Modiglass Fibers, Inc.; Valley Forge Metals Co.; and Nicolet Asbestos Mines, Ltd.

Consolidated at the Florham Park location are: chemical and physical testing laboratories; an engineering section; a workshop; and a pilot area, where asbestos and glass fiber products will be evaluated. Centralization of these activities, which previously had been situated at widely-separated locations, is expected to facilitate customer service.

Dr. Piero Modigliani, who developed the processes for continuous glass fiber forming used by Modiglass, has been named executive director of research for that organization. The fibers, manufactured at Bremen, O., are used in many plastics reinforcing applications such as corrugated panels, vehicle bodies, waterskis, boats, tubs, trays, and swimming pools.

Company Changes Name

National Cylinder Gas Co., Chicago, Ill., whose diversified operations had long outgrown the implication of its corporate title, has changed its name to Chemetron Corp. The new title, a synthesis derived from the words chemicals, metals, and electronics, received the unanimous vote of the board of directors, and was submitted for approval by the stockholders at the firm's annual meeting May 6th.

An outgrowth of the 1953 merger of National Cylinder Gas Co., and Girdler Corp., Chemetron now comprises seven

divisions, an international subsidiary, and two affiliated companies. Net sales by the domestic operations during 1957 amounted to more than $147-million.

A divisional break-down of the company includes: National Cylinder Gas Div., a processor of industrial and medical gases, and maker of allied equipment; Tube Turns Div., a manufacturer of welding fittings and flanges for industrial piping systems; Pennsylvania Forge Div., makers of open-die forgings and forged steel flanges; Girdler Process Equipment Div., whose products include Thermex high frequency heating equipment, and Votator continuous processing apparatus; Girdler Construction Div., builders of chemical process plants; and Chemical Products Div., makers of both heavy and fine chemicals. Perforating Guns Atlas Corp., a subsidiary operating in a divisional status, provides services for electrical and radiation well logging to determine geologic formations primarily in gas and oil fields.

Two 50%-owned subsidiaries include Tube Turns Plastics, Inc., and Midwest Carbide Co. The former manufactures PVC pipe-fittings, flanges, valves and other products by an exclusive injection molding process; while the latter makes calcium carbide which is used in the production of acetylene.

Sun Rubber Wins Patent Suit

The United States District Court in Cleveland has ruled in favor of Sun Rubber Co., against National Latex Products Co., Ashland, O., and Akron Presform Mold Co., Cuyahoga Falls, O., in a patent infringement suit. The patents in question were the Molitor Patent 2,629,134 and the Martin and Rekettye Patent 2,629,131 which covered a method of making hollow vinyl articles and the machinery involved, respectively. The decision is expected to be far reaching in the doll, ball, and toy industries.

Increases Teflon Rod Output

Installation of additional extruders at Tri-Point Plastics, Inc., Albertson, N. Y., has enabled the company to boost its production of TSI type Teflon rod by 25%. This expansion of facilities permits extrusion of nearly 50 different rod diameters ranging from 0.125-1.250 inches, at tolerances of 0.001-inch.

TSI rod is a relatively recent development providing a fluorocarbon stock of consistently high and uniform density. It can be used to machine parts to tolerances as close as 0.0005-inch; has good thermal, dielectric, and corrosion-resistant properties; and has found many applications in the electronics, guided missiles, mechanical, and instrument fields.

Awarded Construction Contract

Engineering contracts covering expansion of Texas Eastman's polyethylene plant at Longview, Tex., have been awarded to Girdler Construction Div., Chemetron Corp., Chicago, Ill. In addition to engineering, the contract calls for procurement of equipment and material necessary to increase the plant's annual polyethylene capacity to 180-million pounds by the end of 1958.

Earns Safety Award

Employees of American Cyanamid Co.'s plastics and resins division, located at Bridgeville, Pa., recently were awarded the Cyanamid Safety Award for having worked more than 2,400,000 injury-free man hours during the past two years.

The award, which was the fourth company safety-citation received by the Bridgeville plant, was presented by V. E. Atkins, general manager, manufacturing services division. H. A. Van Brocklin, plant manager, received the plaque and presented it to a two-man committee representing all of the 557 employees.

Splits Chemical Division

Two separate divisions, one to handle plastics, and the other to produce chemicals and dyestuffs, have been formed by Koppers Co., Inc., Pittsburgh, Pa. The newly-created units will take over the operations formerly handled by the company's chemical division which is being eliminated.

Heading up the plastics division will be David L. Eynon, Jr., as vice president and general manager. Mr. Eynon resigned the presidency of Mobay Chemical Co., to occupy his new post. T. C. Keeling, Jr., a former divisional assistant vice president, has been promoted to vice president and general manager of the chemicals and dyestuffs organization.

Company officials believe that concentration of efforts in both fields can be better expedited by two separate divisions. The firm plans an expansion in the fine chemicals field; while in plastics, a high density polyethylene plant in coming on stream at Port Reading, N. J., and an expandable polystyrene plant will go into operation soon at Kobuta, Pa.

Home Construction Seminar

A special session entitled "The Dwelling House: An Emerging Technology," is being offered this summer by Massachusetts Institute of Technology, Cambridge, Mass. Scheduled for the two-week period beginning Monday June 23, and ending Thursday, July 3, the program is being presented jointly by the Institute's Department of Architecture and the Department of Civil and Sanitary Engineering.

The program will review the developments and implications of new technologies that are emerging in home design, materials, construction, siting, financing, and marketing. New materials as well as innovations in prefabrication and modular coordination will be surveyed. The various subjects will be discussed by representatives of industry, and the architectural and engineering professions.

The school's dormitory system is available to all registrants. Rooms for single men, as well as a limited number of accommodations for married couples and single women may be reserved. Tuition for the session is $250, payable upon notification of admission. Applications may be obtained by writing to: Director of the Summer Session, M.I.T., Cambridge 39, Mass.

Buys Eastern Resins Firm

Name, assets, and good-will of Krumbhaar Chemicals, Inc., South Kearny, N. J., have been purchased by Lawter Chemicals, Inc., Chicago, Ill. The Krumbhaar firm, manufacturers of specialty resins and pure phenolics, will continue to operate under its own name at the same location.

This acquisition enables Lawter, with its production of alkyd resins, printing ink vehicles, and fluorescent products, to expand sales operations in allied fields formerly serviced by Krumbhaar. William Manko has been named vice president in charge of the newly-acquired company.

Signs License Agreement

Under the terms of a recently-signed license agreement, Pantasote Co., New York, N. Y., will manufacture plastics packaging materials using processes and special machinery developed by Italiana Nest-Pack, S.P.A., Bologna, Italy. Pantasote's product, trademarked Panta-Pak, will be vacuum-formed from vinyl resin compounds at the company's plant in Passaic, N. J.

First applications will take the form of trays for commercial fruit packaging. Price-wise, the product is competitive with paperboard, and is already widely used in Europe for fruit, confectionaries, pharmaceuticals, and other items that require shock-protection.

Makes Styrene Graft Polymer

With completion of the first step in its recently-announced expansion program, Foster Grant Co., Inc., Leominster, Mass., has gone on-stream with a new plant for the production of Fosta Tuf-Flex, a high impact polystyrene molding material. A virtually colorless, graft polymer, this material yields finished products exhibiting superior flex resistance, resiliency, and heat and color stability.

Fosta Tuf-Flex can be extruded, vacuum formed, or injection molded with no modifications of standard equipment required. Applications include: cabinets and housings for appliances, molded parts and accessories for refrigerators, and food packaging.

Builds Second Dacron Plant

A multi-million dollar facility for the production of Dacron polyester fiber, is being constructed at Old Hickory, Tenn., by E. I. du Pont de Nemours & Co., Wil-

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Flow temperature: (°C.) (A.S.T.M.)	D569-48	145–183
Specific gravity	D176-42T	1.18–1.21
Tensile properties:		
Break (p.s.i.)	D638-52T	1900–5900
Elongation (%)	D638-52T	48–63
Flexural properties:		
Flexural strength (p.s.i. at break)	D790-49T	3300–10700
Rockwell hardness: (R scale)	D785-51	−15–106
Izod impact: (ft. lb./in. notch)	D256-43T	2.7–11.0
Heat distortion: (°C.)	D648-45T	51–70
Water absorption:		
% sol. lost	D570-42	0.00–0.08
% moisture gain	D570-42	1.5–1.8
% water absorption	D570-42	1.6–2.0

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mington, Del. Upon completion in 1959, its 56-million pound annual capacity will supplement output from the company's first Dacron plant, which went into commercial production at Kingston, N. C., in March 1953.

Occupies Larger Quarters

U. S. Metal Coatings Co., Inc., formerly located in Elizabeth, N. J., has moved to a larger building in Middlesex, N. J. The company specializes in hard-chromium plating of heavy equipment components; handles grinding, polishing, and finishing operations; and performs copper plating, and precision finishing of gravure and printing rolls for the graphic arts industry.

Builds Testing Laboratory

A research and development laboratory, enclosing 21,000 square feet of floor space, has been erected by Cincinnati Testing and Research Laboratories, Inc., Cincinnati, O. Located in suburban Woodlawn, adjacent the Milcreek Expressway, the building replaces the company's previous facilities in downtown Cincinnati.

An independent research organization, C.T.L.'s main areas of activity include polymer research; development, design, and production of reinforced plastics and polymer coatings; mechanical, electrical, and environmental testing; and specialized parts production. In addition to running qualification tests for U.S. Government specifications, the firm maintains a consulting staff to assist in problems involving any phase of plastics production.

Four-Point Expansion

A four-point expansion program calling for investments in excess of $800,000 has been announced by Cadillac Plastic and Chemical Co., Detroit, Mich. Salient features of the move include: construction of a new extrusion plant at Warren, Mich.; signing of a multi-regional agreement for distribution of Du Pont's Mylar polyester film; assembly of complete distributor's stocks of lay-flat polyethylene tubing, which will find outlet through the company's 10 regional warehouses; and creation of a product sales division, to be headed by Kenneth A. Glabach, former district sales supervisor for St. Regis Paper Co.'s Panelyte division.

Tests Latex Paints

Water-based latex paints, made from Bakelite vinyl acetate resin WC-130, are undergoing a series of outdoor-exposure tests to determine their weatherability characteristics, according to a report by Bakelite Co., New York, N. Y. The paints have been applied to several different types of construction materials at locations in Maine, Massachusetts, New Jersey, Pennsylvania, Minnesota, Michigan, West Virginia, Alabama, and California.

While final evaluations are not expected for several years, it is believed that the latex paints will last considerably longer than the average three-year life of conventional paint. Preliminary results indicate best performance on cement-asbestos shingles, concrete, stucco, brick, and cement block.

Architect's drawing of J. O. Ross Corp.'s midwestern office.

Erects Midwestern Offices

A 12,500-square-foot office building, to be located at Mt. Pleasant, Ill., a suburb of Chicago, is being constructed by J. O. Ross Engineering division, Midland-Ross Corp., New York, N. Y. Scheduled for completion this coming September, the building also will provide accommodations for Chicago personnel of John Waldron Corp., a unit of Ross Engineering.

The company fabricates and installs air process systems used in industrial heating, drying, and curing operations; while John Waldron manufactures web converting machinery and flexible couplings. The Chicago office, headed by vice president L. G. Janett, services the territory bounded by Canada, Gulf of Mexico; Rocky Mountains, and the middle eastern states.

Develops Fiber Forming Resin

A polyester resin for use in production of textile fibers has been developed by Goodyear Tire and Rubber Co., Akron, O. Described as a linear co-polyester, the resin, tradenamed Vytel, will be produced in a plant currently under construction at Apple Grove, W. Va.

Although still in the pilot plant stage, volume production is expected by early 1959, and end products probably will reach the consumer level later that year. Vytel products reportedly demonstrate exceptional strength, resiliency, and flexibility, in addition to showing good ultraviolet light resistance. Used alone, or blended with other synthetics or natural fibers, the new fiber will be made into wearing apparel and related items. The resin will be marketed under the direction of H. R. Theis, general manager of Goodyear's chemical division.

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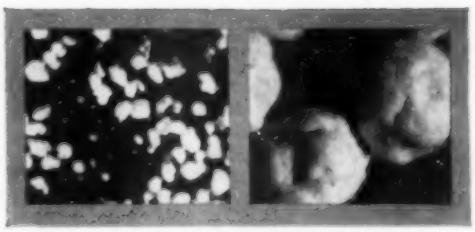

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Names in the News

Kent W. Smith

Kent W. Smith has been elected vice president of Improved Machinery, Inc. He had been treasurer of the company since early 1949, and a director since September of that year. Mr. Smith first joined IMPCO in 1942 as office manager,

John Dunbar, formerly an industrial sales manager for Willys Motors, has joined the sales department of L. O. F. Glass Fibers Co., and has been assigned to the Milwaukee district.

W. Pat Fralia has been named sales manager of Lone Star Plastics Co., Inc., Fort Worth, Tex. For the past seven years he had been a sales engineer with Texas Electric Service Co., and Engineering Supply Co. In his newly-created position, Mr. Fralia will be responsible for setting up a country-wide sales staff.

John J. Ratto has been appointed general sales manager of Pelron Corp., Lyons Ill. **William Clement** and **Ronald Greiner** have been named technical sales representatives for the Michigan area, and will represent the polyurethane division of the Detroit office.

Russell M. White has been appointed general manager of the newly-created international division, Stauffer Chemical Co. He will be responsible for the acquisition of foreign rights for processes and products, licensing of Stauffer patents, and export sales.

Robert H. Zabel has been appointed manager of the plastics and elastomers section at the new technical service laboratory of Du Pont's pigments department, Chestnut Run, Del. He joined the firm in 1948 as a production supervisor, and more recently served at the Newark sales service laboratory.

Wells E. Hudson has been named project manager for Pittsburgh Coke & Chemical Co.'s commercial development department. He previously served as vice president and general manager of Great Lakes Chemical Corp.

Harry T. Marks has been elected president of Ferro Corp. A 25-year man, Mr. Marks formerly served as executive vice president. He succeeds the late C. D. Clawson.

L. W. Donnelly has been named engineering supervisor at Monsanto Chemical Co.'s plastics division plant in Texas City, Tex. He has served as senior engineer since 1956. **Edgar B. Peek** joins the engineering department, and will serve under Mr. Donnelly. **Irving Tashlick** and **Joel H. Graham** have joined the plastics division at Springfield, Mass., and will serve in the research department and as a safety engineer, respectively.

Dean Daniels has become Western district sales manager for General Electric's silicone products department, and will maintain offices in Downey, Calif. He succeeds **Robert T. Dailey,** who has become manager of rubber market development.

James D. Bettridge

James D. Bettridge has been appointed general sales manager of L.O.F. Glass Fibers Co.'s distributor division. He will be responsible for all distributor sales of the firm's home insulation, pipe insulation, and acoustical ceiling panel. The vacancy in the product planning department created by his promotion will be filled by **Malcolm C. Brown,** former manager of the Kansas City district.

Albert M. Hunt has joined General Electric's chemical & metallurgical division as chemist in the new product development laboratory. A former development chemist with Transformer Laboratories, he will work on the Lexan polycarbonate resin project.

Woodrow H. Pereira has been appointed manager of the new sales office recently opened by Federal Tool Corp., at 230 Fifth Ave., New York City. He formerly represented the firm through Harold Everts Co., sales representatives. Named as assistant manager is **Howard Bruno,** a former New England representative of Federal.

Robert Barbin has been appointed sales correspondent for Devcon Corp., Danvers, Mass. He formerly served as a technician in the research laboratory.

Leo Poccia has joined the staff of Conap Co., a plastics research & development concern located in Olean, N. Y. He formerly served as technical director of Arvey Corp.'s Fibre Forming division.

W. R. Clark has been appointed sales manager; **W. H. Guthrie** manager of sales promotion; **R. M. Wallace** sales coordinator; and **D. S. Sherwin** manager of marketing research for the plastics sales division of Phillips Chemical Co. Mr. Clark previously served as senior sales engineer and assistant sales manager, and the other three men served in various capacities for other Phillips' divisions.

James W. Frevert has been appointed production manager at Air Reduction Chemical Co.'s vinyl acetate monomer plant, Calvert City, Ky. He is replaced as plant superintendent by **James H. Burgess,** former control chemist. **Kenneth T. Cardner** succeeds Mr. Burgess. **Clifton E. Cowan** and **H. J. Shuecraft, Jr.,** have been named operating foremen.

Edward A. Coons has been named general manager of Acheson Dispersed Pigments Co., Philadelphia, Pa. A former employe of Du Pont and Sinclair Refining Co., he most recently served as general manager of Armour's chemical division. Mr. Coons will supervise operations at the manufacturing plants in Philadelphia; Orange, Tex.; and Xenia, O.

Thomas J. Campbell has been appointed sales manager of Metasap Chemical Co., a subsidiary of Nopco Chemical Co. Formerly the assistant sales manager, he succeeds **O. E. Lohrke.**

W. Mayo Smith has been appointed director of research for Escambia Chemical Corp. Dr. Smith formerly served as assistant director, in charge of polymerization and plastics research & development. He will be located at the new Research Center in Wilton, Conn.

Harvey G. Wismer has been elected vice-president of Mannesmann-Easton Plastic Products Co., Inc., Easton, Pa., a manufacturer of rigid plastic pipe. A company employee since 1952, he formerly served as general manager.

Harry A. Russell

Harry A. Russell has been elected vice president of Pantasote Co., Passaic, N. J. Formerly the technical director, he will be in charge of research and development for the main plant and its divisional plant, the Eleanora Chemical Corp.

Howard Zimmer has been named sales representative for H. Kohnstamm & Co., Inc., in the states of Washington and Oregon. A pharmaceutical chemist, he formerly served as Northwest sales supervisor for Chas. Pfizer & Co., Inc.

Kenneth P. Pitt has been appointed manager of Formica Corp.'s Eastern regional office in White Plains, N. Y. He joined the firm in 1943 as purchasing agent, has sold, and most recently served as assistant district manager in Boston.

Everett Griffin has been elected to the board of directors of Chemical Process Co., Redwood City, Calif., increasing the total number from seven to eight.

Patrick Law has been appointed district sales manager, Southern division, for Haskelite Mfg. Corp., Grand Rapids, Mich. He formerly sold curtainwall materials for H. H. Robertson Co.

John N. Pattison has been appointed director of research and development for Girdler catalysts in the chemical products division of Chemetron Corp. Former head of Cities Service's catalyst research section, Dr. Pattison will make his headquarters in Louisville, Ky. **John W. Benedict** has been named sales manager for the Girdler catalysts. He most recently sold for W. R. Grace's Davison Chemical division.

Reichhold Chemicals, Inc., White Plains, N. Y., has announced the appointments for four divisional managers for chemical sales: **W. D. Conrad,** Central Atlantic division, Charlotte, N. C.; **W. A. Gerhardt,** Pacific Southern division, Azusa, Calif.; **G. D. Lamont,** Midwest division, Detroit, Mich.; and **R. J. Read,** Northeastern division, Ballardville, Mass.

Carter L. Burgess has been elected president of American Machine & Foundry Co. He previously served as president of Trans World Airlines.

Edward Lang has been appointed to the management staff of Furane Plastics, Inc., as sales coordinator. He previously served with Lockheed Aircraft Corp. and Chrysler Corp.

Vernon L. Larson has been named assistant sales manager of surface coating materials for Bakelite Co. He has served the firm as special correspondent and as a technical representative. **Henry W. Greenhood** has been appointed Western zone sales manager for surface coating materials, and will maintain headquarters in Chicago. He also served as a technical representative.

Philip G. Magnusson has been appointed sales manager, calendering materials, for Bakelite Co. This covers the firm's vinyl and polyethylene materials for floor coverings, pipe wrap, coated fabrics, rigid sheeting, and plasticized film and sheeting. He will also direct the sales of styrene and chlorinated additives for calendering.

Richard C. Burck has been named manager of product development for Mobay Chemical Co. He joined the firm in 1955 as supervisor of product development, after serving seven years with Minnesota Mining & Mfg.'s adhesives & coatings division.

Valentine B. Chamberlain, Jr., has been elected treasurer of the vinyl dispersion division, Society of Plastics Industry, Inc. Mr. Chamberlain is sales manager of the Stanley Chemical Co.

Stephen Simon has been named general sales manager for all company divisions of Barclay Mfg. Co., Inc., Bronx, N. Y., manufacturer of building materials. **Ernest S. Swanson** has been appointed director of the Barcwood plasticoated paneling division, and **John W. Grist** has become product manager for Barclite reinforced plastic paneling. New sales office manager for all divisions is **John Baum,** and **Jerry Hart** will serve as advertising & sales promotion manager.

Joseph Foier has been elected vice president and sales manager of American Molding Powder & Chemical Corp., Brooklyn, N. Y. He has held supervisory positions with the firm since 1953, both in sales and in production.

Jack H. Kubanoff has joined Fluorocarbon Products, Inc., a division of U. S. Gasket Co., and will be responsible for the design, development, and engineering of that company's products. He previously served with Remington Rand Univac as senior engineer.

John C. Milne has been appointed product manager, compound-applying machinery, for the Dewey & Almy division of W. R. Grace & Co. He will supervise sales of the division's machines for applying "Flowed-in" sealing compounds to ends and side seams of cans and other containers.

Kenneth T. Carolan has been elected vice president of Carmer Industries, Inc., Kenilworth, N. J. He will continue to serve as general production manager for Kel-F, nylon, and Teflon rods and tubes. **Gordon Britt** has been named sales manager.

Roy J. Sund, executive vice president of Marathon Corp. before its merger with American Can Co., has been elected a vice president of the latter firm. Since the merger, he had been supervising operations of the Marathon division.

Robert L. Duncan has been named sales manager of Union Carbide Chemicals Co., a promotion from assistant sales manager. He joined the firm in 1937 and, with the exception of military service, has served continuously in various sales capacities. He became manager of the Albany district in 1946, Detroit in 1949. In 1954, Mr. Duncan was made Eastern divisional manager.

William B. Philipbar, Jr., has been appointed product sales manager, stearates division, for Nuodex Products Co., a division of Heyden Newport Chemical Co. He previously served with Esso Standard Oil Co.

Robert E. Leber has been appointed general sales manager of Ansbacher-Siegle Corp., Staten Island, N. Y. He will be responsible for all pigment and colors sales to the plastics, cosmetic, paint, and floor covering industries.

OBITUARY

G. Victor Sammet, Sr.

G. Victor Sammet, Sr.

G. Victor Sammet, Sr., 77, co-founder and former president of Northern Industrial Chemical Co., South Boston, Mass., died April 13, after a short illness. He resided at 24 Vineyard Road, Newton Center, Mass.

A graduate of Massachusetts Institute of Technology, class of 1901, Mr. Sammet was awarded a Rhodes Scholarship and continued his studies at the University of Leipzig (Germany), where he was granted a Ph.D in chemistry. Upon his return from Germany, he joined the chemical department of Merrimac Chemical Co. In 1907, he became a co-founder of Northern Industrial Chemical Co., and served as president of that organization for 49 years until his retirement in 1956.

He was one of the founders of the Plastic Manufacturing Group, which later became the Society of the Plastics Industry, Inc.; a member of the Brae Burn Country Club of Newton; and the Plastics Pioneers Association. Mr. Sammet is survived by his wife, Viola White Sammet; a son, George V. Sammet, Jr.; a sister; and two grandchildren.

Harlan Richard Wheaton

Harlan Richard Wheaton, 37, assistant director of new products and development, Standard Ultramarine & Color Co., Huntington, W. Va., died April 7, 1958, when an airplane in which he was traveling crashed near Midland, Mich.

A native of Huntington, Mr. Wheaton was graduated from Vinson High School in 1939, after which he attended Georgetown College, Georgetown, Ky. In 1941, he joined Standard Ultramarine as a laboratory assistant, where his work was continuous with the exception of a three-year period during World War II when he served with the U.S. Marine Corps. Funeral services were held at the First Methodist Church of Catlettsburg, Catlettsburg, Ky. The deceased is survived by his wife, Geraldine Meade Wheaton, a son, and a daughter.

News from Abroad

1957 Canadian Plastics

Canadian consumption of practically every type of plastic material showed more or less pronounced growth during 1957. The one exception seems to have been melamine molding powder which, for the time being at least, apparently is making no progress. The greatest advance was made by polyethylene, total consumption of which increased 45% during the year. A further increase of 30% is expected in the current year, especially for wire coating. Last year, the chief market for polyethylene was in film. Unplasticized PVC still heads the list of plastics consumed here, with 1957 figures about 20% above those for 1956. Polystyrene felt the effects of the inroads of polyethylene, nevertheless consumption of this material continued to rise at a satisfactory rate.

The following table gives data on the consumption, in pounds, of primary plastics in Canada during 1957:

Polyvinyl chloride	36,750,000
Polyethylene	35,400,000
Phenolic resins	28,500,000
Polystyrene	15,500,000
Nylon molding powder	250,000
Phenolic adhesives	22,000,000
Urea molding powder	400,000
Polyesters	3,500,000
Melamine	8,500,000
Epoxy resins	1,600,000
Cellulosics	6,400,000
Vinyl acetate	6,000,000
Vinyl alcohol	2,000,000
Vinyl acetal	250,000
Acrylic	600,000
Urethanes	400,000
Total:	168,050,000

During 1957, many new plants and plans were announced by the plastics industry. Canadian interest in the newer plastics has prompted the establishment of plants for their production locally. Thus, Shell Chemical and Bakelite are to manufacture epoxies; Naugatuck Chemicals is building a new polyester plant; Reichhold Chemicals opened a new polyester plant during 1957; and Robinson Molded Products, which has been producing polyester-based urethane foams, is to start producing foams using their own pre-polymer systems for making polyether-based urethanes.

Canadian production of plastic materials, in pounds, in 1957 is shown below:

Vinyl acetate monomer	44,000,000
Cellulose acetate flake	45,000,000
Polystyrene	38,000,000
Phenolic resins	25,000,000
Polyvinyl chloride	23,250,000
Nylon (chiefly textiles)	25,000,000
Phenolic adhesives	13,500,000
Polyethylene	29,000,000
Urea adhesives	5,000,000
Vinyl acetal	300,000
Polyesters	3,500,000
Total:	251,550,000

A total of 58,900,000 pounds of assorted plastic materials was imported into Canada in 1957, as follows:

Polyvinyl chloride	13,500,000
Polyethylene (all types)	11,000,000
Polystyrene and copolymers	5,400,000
Phenolic resins	3,500,000
Phenolic adhesives	8,500,000
Urea molding powder	400,000
Melamine	8,500,000
Epoxy resins	1,600,000
Cellulosics	6,400,000
Urethanes	100,000
Total:	58,900,000

As in previous years, imports of PVC depressed prices, while those of polyesters hampered local production to some extent.

New German Developments

Schering A.G., Berlin-West, and General Mills Inc., Kankakee, Ill., have entered an exclusive agreement for the sale of Versamid polyamide resins in West Germany and Austria. The selling organization of the German firm will undertake sales, and its scientific department will provide technical advice to consumers. The news of this arrangement has been received with interest as a forecast of Schering's resumption of its prewar role in research and sales for the plastics industry.

Reinforced Thermoplastic Sheet

Details have been released on a British method of introducing reinforcing threads into polyethylene (or other thermoplastic) sheet, thereby yielding a new type of composite sheet that is claimed to be almost indistinguishable from woven fabric embedded in sheet polyethylene. It can be bonded and/or sewn; is claimed to be practically untearable; and can be produced at a lower cost than unreinforced sheeting because thinner films of plastic can be used. The process, which is protected by provisional patents, consists essentially of placing two layers of threads extending in the same direction in a zig-zag formation between two thin films of polyethylene in such a way that adjacent threads of the two sets of threads overlap and cross each other. The plastic films then are bonded together by heat and pressure, and the final product is virtually one solid sheet with the threads firmly embedded in the plastic.

The threads may be nylon, Terylene, linen, cotton, flax, and all kinds of designs, not only zig-zag formations, are possible. By using color and varying the size and shape of mesh, as well as by increasing the number of sets of thread, various attractive designs are obtainable.

The process lends itself to the manufacture of decorative materials, resembling fine lace and suitable for use in table cloths, curtains, and the like, as well as to the production of more utilitarian goods. Thus, because thinner polyethylene sheet is used and light penetration consqeuently is better, the new reinforced sheets serves for making horticultural apparatus like cloches, greenhouse lights, etc., where maximum light penetration is important. With close-mesh hemp reinforcement, slightly thicker-gage polyethylene yields a material resembling woven jute bagging of surprising strength and resistance to tearing. Reinforced with nylon, it may prove suitable for sail-cloth. With a slight modification of method, the principle can be employed to reinforce two fairly thick sheets of polyethylene with fine wire, or the wire can be embedded into a single sheet of the plastic during the actual formation of the sheet.

On the same principle, reinforced roofing papers also can be made when the threads are zig-zagged simultaneously between two papers at the same time that the tar is applied. Paper for packaging, carrier bags, and the like can be reinforced with all types of thread by using a suitable adhesive as bonding agent.

Russian High Polymer "Drive"

The news from Russia reveals that a drive is now under way to make the Soviet Union "the world's largest producer of polymers" in the next few years. The Soviet government demands a 53.6% increase this year in investment in the state chemical industry, with construction for the synthetics industry to be increased by 150%, and outputs of synthetic fiber and synthetic rubber to be 75% and 48% higher, respectively. The best efforts of the best chemists and the best research institutes are to be diverted to the realization of the ambitious polymer program.

To Increase Output

The considerable interest shown in polypropylene and the demand for it in Italy, as well as in foreign countries, has led to the decision by Montecatini, the Italian chemical firm, to expand production of Moplen at its Ferrara works from present annual capacity of 15,000,000 pounds to 45,000,000 pounds. The company has just developed an improved and simpler process, and the new additions will be designed and equipped accordingly.

Montecatini's experiments on the manufacture of polypropylene fiber have proved successful enough so that the firm could report some months ago that it was ready to produce 15 tons monthly. According to a statement credited to Prof. Natta, this fiber will become the cheapest synthetic fiber produced as yet.

New Materials

Write item numbers on Readers' Service Card to obtain more information.

Two Diallyl Phthalates

Mesa Plastics Co. has come up with two heat-resistant (500° F.) diallyl phthalate compounds which are reported to have superior electrical and structural properties. Diall FS-4 is filled with long glass fibers; Diall FS-5 with short glass fibers.

Both materials do not give off phthalic anhydride or other decomposition products when heated, thus destroying electrical contacts. They are molded at conventional temperatures (300° F.), in conventional dies, and with conventional procedures. Specifications are quoted as follows:

	FS-4	FS-5
Color	Brown	Brown
Form	Flakes	Powder
Molding pressures, psi., compression	500-2,000	500-2,000
Transfer	1,000-8,000	1,000-8,000
Curing time, med. thin sections, min.	1	1
Molding temperatures, °F.	270-320	270-320
Recommended performing procedure	Special	Regular
Bulk factor	4	2.2-2.3
Mold shrinkage, in./in.	0.002	0.002
Specific gravity	1.55	1.59
Water absorption, 48 hrs. @ 122°F., %	0.11	0.10
Flexural strength, psi	19,000	15,000
Flexural modulus, psi, x 10^6	1.4	1.3
Compressive strength, psi.	29,500	30,500
Impact, strength, ft.lbs./in. notch	9	1.2
Tensile strength, psi.	9,500	8,500
Heat distortion, °F	490	450
Flame resistance, ignition time, sec.	100	100
Heat resistance, continuous, °F.	450-500	450-500
Arc resistance, sec.	180	180
Dielectric strength, V./mil.	400	420
Volume resistance, megohms	10^9	10^9

Readers' Service Item M-1

Very Low-Density Polyethylene

A new polyethylene exhibiting many of the properties of conventional polyethylenes, yet capable of being handled like a moderate to high melting point wax has been introduced by Eastman Chemical Products, Inc. Identified as Epolene C, the material has a low viscosity (8,000 cps.) at a relatively low temperature (300° F.). The addition of 25% paraffin, with which it is completely compatible, reduces the viscosity to 1,300 cps. at this same temperature.

Designed for use in the packaging field, Epolene C can be used as a melt casting to form relatively hard, cast or slush molded objects. To further extend this use, lacquers are being developed to decorate such possible applications as dolls and toys. As a hot dip, it has been used for the protective coating of a wide variety of products.

Commercially, the material is being used as a hot melt for roll coating virtually all types of papers. This was found to be a much more economical procedure than the lamination of extruded polyethylene film to paper by means of hot rolls. Epolene C can be handled in conventional wax-coating machines by providing slightly higher temperatures in the fountain. Excellent bonds are formed, since the melt penetrates into the paper to a higher degree. This also provides for an unusually high gloss.

Typical properties are reported as follows:

Acid number	0.1
Saponification number	0.1
Color, Gardner	2
Specific gravity (density)	0.907
Flash point, Cleveland Open Cup, °F	600
Fire point	Same
Ash content, %	0.012
Tensile strength, psi	850
Ultimate elongation, %	80
Durometer hardness, A scale, 5 sec.	97
Dielectric constant	2.25
Dielectric strength, volts/mil.	600
Dissipation factor, 1 mc., x 10^{-4}	3.3

Readers' Service Item M-2

Polyester Resin Catalyst

A solid, crystalline ketone peroxide which can be used to catalyze polyester resins at low or room temperatures has been introduced by the Lucidol division of Wallace & Tiernan, Inc. Called Luperox 6, the material gives faster gel times than other commercially-available ketone peroxides when used in conjunction with metallic promoters. Pot life is considerably longer, if no selected accelerators are present.

Cure time is long and, with certain resins, a lower-peak exotherm temperature is obtained than with other ketone peroxides. The above-mentioned properties are said to be advantageous in molding, casting, and potting applications where crazing must be avoided.

While Luperox 6 is relatively stable at ordinary temperatures, prolonged storage above 80° F. may cause loss in active oxygen. Extended exposure to temperatures above 130° F. can cause rapid and violent decomposition, thereby constituting a fire hazard. Caution labels are carried on each container.

Specifications are quoted as follows:

Content, ketone peroxide, %	90
Active oxygen, %	6.25
Melting point, °C.	66-68
Form	Fine powder
Color	White
Solubility at 20° C., wt. % in water, glycerol, ethylene glycol, most esters, & hydrocarbons	1-5
In alcohols, tricresyl phosphate, ketones, & chlorinated hydrocarbons	5-15
In ethers and methanol	15-50

Readers' Service Item M-3

Vinyl-Polyester Lubricant

A pure white lubricant in flake form which gives excellent release and finish qualities to vinyls and polyesters has been introduced by Isochem Corp. Designated Isochem Wax 220, the material is a completely-saturated long-chain hydrocarbon with excellent resistance to high temperatures. Its special feature is freedom from flow at all temperatures under 200° F.

In addition to its use as a mold lubricant, Isochem Wax 220 is said to be very good as an extender, anti-tack additive, and hardening or stiffening agent. Its electrical properties make it valuable for coating, modifying, and capacitor work. Other properties are reported as follows:

Melting point, °F.	220
Specific gravity	0.930
Needle penetration	1.000
Viscosity @ 250° F., cps.	9.5
Mole weight	800
Odor	None
Ash content, %	<0.1
Oil content, %	<1.0
Acid, saponification, & bromine number	None

Readers' Service Item M-4

Phenolic Laminate

A paper-base phenolic laminate, possessing excellent electrical characteristics has been introduced by Taylor Fibre Co. Designated Grade 320, the laminate is recommended for use in critical electric and electronic circuits, and meets the requirements of MIL-P-3115, type PBE-P specifications.

Grade 320 is mechanically strong, resistant to fungus growth, and maintains its electrical characteristics after prolonged exposure to high humidity. Other features include low dielectric loss; and high dimensional stability, insulation resistance, and surface resistivity.

Available in sheets measuring approximately 49 by 49 inches, and thicknesses ranging from 0.020-1 inch, the laminate is light in color, has a semi-gloss surface finish, and medium translucency. A summary of its physical properties is as follows:

do you have a
RELEASE PROBLEM
with rubber?
plastics?
film casting?
medical plasters?
pressure sensitive tape?

PATAPAR® RELEASING PARCHMENTS PEEL OFF EASILY, CLEANLY

Gives satin-like finish to corrugated polyester Fiberglas sheets

Release backing for pressure sensitive surfaces

Separator for rubber tape

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These special Patapars show excellent performance in many processes involving: *synthetic rubber, polyurethane foams, polyesters, vinyl, organic adhesives, organosols, phenolics, acrylics.*

Features of Patapar Releasing Parchments include dense, fiber-free texture – high resistance to penetration or migration of oil and softeners – inertness to any surfaces they contact–rigidity or flexibility as desired – easily printable.

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PATERSON PARCHMENT PAPER COMPANY
Bristol, Pennsylvania
Sales Offices: New York, Chicago
West Coast Plant: Sunnyvale, California

HEADQUARTERS FOR VEGETABLE PARCHMENT SINCE 1885

	Thickness, in. 1/16	1/8
Water absorption, % max.	0.30	0.17
Dissipation factor,* max.	0.023	0.023
Dielectric constant,* max.	4.55	4.55
Dielectric loss factor,* max.	0.104	0.014
Insulation resistance, megohms	700.000	750.000

* At one megacycle

Readers' Service Item M-5

100% Reactive Silicone Resin

A special silicone resin for electrical insulation applications has been introduced by Union Carbide Corp.'s Silicones division. Designated Union Carbide XR-70, the material is 100% reactive, thus eliminating the need for a solvent removal step during cure. This, in turn, allows for the fabrication of thick sections of void-free, corona-resistant, high-temperature (180° C.) insulation.

XR-70's low viscosity is especially suited for vacuum impregnating form-wound coils with mica or glass cloth-mica insulation for operation at Class H temperatures.

Typical physical properties before cure are as follows:

Appearance	Clear, light straw
Specific gravity	1.1-1.12
Viscosity, cps.	250-350
Color, Gardner	1
Gel time, ASTM D555-54, min.	30
Flash point, °F.	360
Shelf life, uncatalyzed, in the dark, mos.	4

Properties, after cure and measured on a 4 x 4 x ⅛ inch casting which is cured 16 hours at 110° C., plus four hours at 150° C., are reported below. For a catalyst, 0.8% DTBH is used.

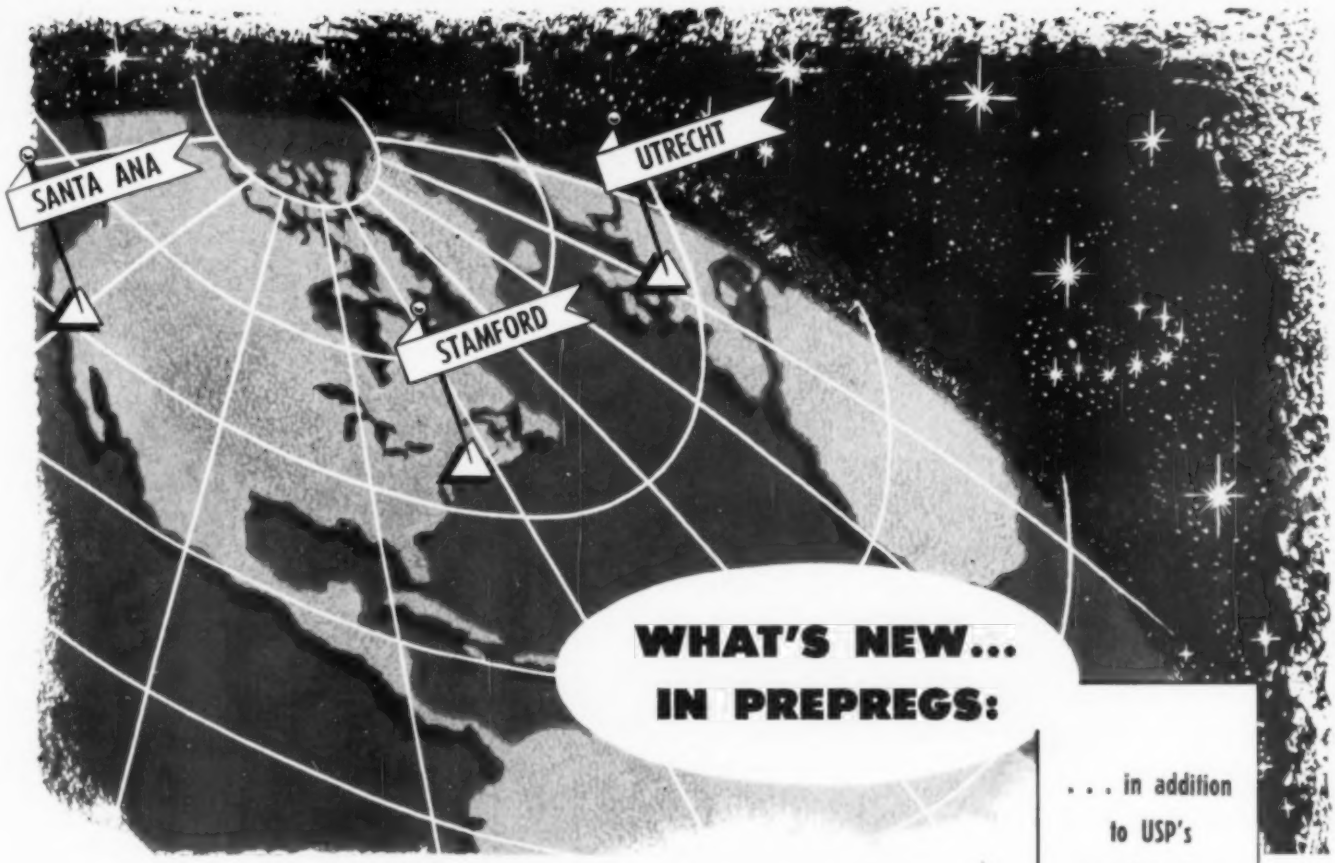
Hardness, Barcol	50-65
Specific gravity	1.18-1.19
Volume shrinkage during cure, %	4.5-5.3
Linear shrinkage during cure, %	2-3
Ultimate tensile strength, psi.	1,500-1,800
Elongation, %	5-7
Weight loss @ 28 days at 250°C., forced air oven, %	11-15
Coefficient of linear thermal expansion	$1.15\text{-}1.6 \times 10^{-4}$
Coefficient of thermal conductivity	2×10^{-4}
Dielectric constant @ 10^3 cps.	3.11
Dissipation factor @ 10^3 cps.	0.0037
Volume resistivity, ohm-cm.	10^{15}

Readers' Service Item M-6

One-Component Epoxy Preform

A single-component epoxy preform designed for automatic or high-production joining of plastics, metals, ceramics, and glasses is presently available from Duramic Products, Inc. Designated Epoxweld 100, the unpolymerized material's pressed shape allows the fabricator to introduce a definite form and shape of bonding material.

The adhesive is said to bridge the gap between expensive metallic solders and the slow-to-handle, two-component epoxy adhesives. A clearance of 4-8 mils is recommended between mating parts, which should be cleaned of grease and dirt by the same methods used prior to soldering and brazing. Epoxweld preforms soften at 120° F., become fluid at 248° F. In mass production work, the assemblies should pass continuously from pre-heat through flow-temperature zones on through the higher-temperature cure zone. Heat can be



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. . . in addition to USP's complete line of POLY-PREG . . .

For the first time, on a production basis, the qualities of strong, rigid reinforced plastics have been combined with flexible rubbers of high wear, tear and permeability resistance — in U. S. Polymeric's POLY-PREG Two-In-One! The production applications of this great new combination are readily apparent. Interlamination of *Silicone Modified Rubber** with POLY-PREG can provide improved qualities to plastics, such as

- . . . *weather and wear-resistant surfaces without pit or scratch*
- . . . *reduction of permeability to gases and liquids*
- . . . *surface smoothness and polish*
- . . . *slower burning rate with self-extinguishing*
- . . . *features*
- . . . *increased flexibility*
- . . . *reduction of delamination*

Likewise, this combination can impart improved qualities to rubber articles, such as reduced distortion under very high pressures and increased resistance to fuels, oils, chemicals and heat.

The selection of specified *Silicone Modified Rubbers** with the appropriate resin POLY-PREG can provide a POLY-PREG T.I.O. with almost limitless use where the rigid strength of plastics combined with the flexibility of rubber is desirable.

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U. S. Polymeric's extensive line of preimpregnated paper, glass cloth and mat now include:

- . . . **Hi-Heat Phenolic POLY-PREG (with 91-LD)**
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Through continual research and development, Polymeric's staff of engineers are creating new products and processes, such as POLY-PREG T.I.O., to meet the ever-increasing demands of industry and defense.

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applied by torch, resistance, or induction methods, and no special pressure is required to obtain a good joint.

The following curing cycles are typical, and must be adjusted to meet specific job requirements:

Joint temperature, °F	Minimum cure time, hours	Maximum cure time, hours
230	48	None
248	24	None
266	10	None
320	2	None
356	1	None
392	0.2	24
428	0.166	1
482	0.1016	0.166
536	0.05	0.0833

Epoxweld 100 Preforms are tailor made for each job. Orderer should send prints of parts, unassembled samples, and pertinent data; Duramic develops the preform and supplies heating cycle requirements. Unfilled Epoxweld powder is available for short-run jobs or experimental work.

Readers' Service Item M-7

Pre-Flocked Formable Sheet

Pre-flocked, formable styrene sheet material is available from Gilman Brothers Co. in 26 standard colors, plain or embossed. Called Stylour, the material comes in thicknesses of 10-30 mils (rolls), 10-125 mils (rigid sheets); in widths of 24-40 inches; and in lengths up to 100 yards.

Previously, plastic formed pieces were flocked after coming from the vacuum press. Not only was the cost high, but it was difficult to apply the flocking and have it hold well. Flocking the sheet before forming produces an even, hard-wearing surface which forms in practically the same cycle as unflocked sheet. Ideal for certain packaging applications, Stylour is marketed also with a tarnish-resistant flock for "setting-off" silverware.

A special adhesive is used, which combines cotton, rayon, and wool flock to the styrene sheeting. Reports indicate that the flocking does not break away from the base sheet, even when deep draws are used.

Readers' Service Item M-8

All-Acrylic Sirup

An all-acrylic laminating resin for general-purpose use is being test-marketed by E. I. du Pont de Nemours & Co., Inc. Tradenamed Lucite, the material is completely free of aromatic components such as styrene or phenolic compounds, and can be low-pressure laminated with glass or organic fibers to yield products with increased strength, rigidity, and toughness.

A clear, colorless liquid, the resin can be processed by conventional methods and equipment. Like polyester-styrene compositions, it can be rapidly hardened by vinyl-type polymerization. Flexural and tensile properties of fabricated products compare favorably with those made from other resins.

The laminates are initially completely free of yellowness if suitable catalyst and clean reinforcement are used, and they remain relatively free of coloring during extended periods of weathering. Samples exposed to 1,500 hours of accelerated weathering and 18 months outdoor exposure in Florida have exhibited superior retention of gloss and light-transmission properties.

When reinforced with 25%, by weight, of chopped glass fiber mat, translucent laminates give up to 65% light transmission. The light is highly diffused, and panels of this type provide good image-hiding power and glare elimination. Individual glass fibers are visible in the laminates because of the large difference in the refractive indices of the resin and reinforcement.

Lucite sirup currently is available in two viscosities: 201X, an 850-centipoise composition for press operations; and 202X, a 250-centipoise resin for contact-pressure lamination. While dilution of either sirup with styrene is not recommended, viscosities can be lowered by the addition of methyl methacrylate monomer. Physical properties of reinforced Lucite panels are compared at two glass fiber loadings, as follows:

Glass, % by weight	40	25
Method of fabrication	Press cure[1]	Contact cure[2]
Hardness, Rockwell R.	125	121
Tensile strength, psi. at 23° C. (D638-52T)	23,000	12,000
Elongation, % at 23° C. (D638-52T)	1.7	1.5
Flexural strength, psi. at 23° C. (D790-49T)	35,000	25,000
At 100° C.	14,000	8,000
At 23° C., wet	30,000	—
Modulus, psi. x 10^6 At 23° C.	1.6	0.9
At 100° C.	0.8	0.3
Compressive strength, psi. at 23° C. (D695-54)	25,000	24,000
Izod impact, ft.-lbs./in. notch (D256-54T)	14	6
Taber abrasion wt. loss, mg./1,000 cycles (D1242-52T, D1044-54T)	30	33
Heat distortion temp. at 264 psi., °F. (D648-45T)	256	233
Coefficient of thermal expansion, linear (D696-45T)	4×10^{-5}	—
Flammability, in./min. (D635-56T)	—	1.3
Dielectric constant at 1,000 cycles	5.0	4.1
Dissipation factor at 1,000 cycles	0.007	0.05
Light transmission, % (1/16-in.)	—	60-65
Diffuse transmission, % of total	—	95-98

[1] Lucite 201X
[2] Lucite 202X
[3] Following two-hr. boil

Lucite resins show excellent stability under normal storage conditions, but exposure to elevated temperatures for long periods should be avoided. The sirup contains methyl methacrylate monomer, and prolonged inhalation of the vapor can cause headaches, gastro-intestinal disturbances; irritation to the skin, mucous membranes, and kidneys. Both the sirup and vapors are flammable, and adequate precautions in this respect should be taken.

Readers' Service Item M-9

A high molecular weight adipate plasticizer!

RC

POLYMERIC BGA

Recommended for use in PVC compounds requiring a primary polymeric plasticizer with outstanding performance qualities such as:

★ Resistance to extraction
★ High rate of solvation
★ Low order of volatility
★ Migration resistant
★ Heat and light stability

Check RC POLYMERIC BGA in wire insulation compounds, gaskets, vinyl-metal laminates, and non-migrating film and sheeting!

WRITE FOR SAMPLES! We'll send you a brochure on all RC products that can speed your operations, improve your products.

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New, patented feature of *Airstream* Conveyors

Now Dracco Airstream Conveyors offer you an exclusive feature which eliminates the formation of "ribbons" or "streamers" on pipeline walls in the pneumatic handling of polyethylene and similar plastics.

A special Dracco patented treatment* prevents the linear build-up of polyethylene which occurs in untreated conveying lines. This unique development assures unrestricted material flow and avoids the fouling of extruders, injectors and other production machinery.

Ribbon-free polyethylene conveying is an important addition to the many other advantages of Airstream Conveyors:

- any degree of automation
- contamination-free handling with completely enclosed, air-tight systems
- conveying air can be purified by filtration and drying
- optional controlled atmosphere systems using inert gases
- self-cleaning . . . dust-free
- no moving parts . . . no metal-to-metal contact
- stainless steel or aluminum construction

To be sure of efficient and economical handling of polyethylene—or any high-purity bulk material—specify Dracco Airstream Conveyors . . . now available with the new **ribbon-free** feature.

*U.S. Patent No. 2,784,038

DRACCO DIVISION OF FULLER CO.
4070 East 116th Street · Cleveland 5, Ohio

New 32-page brochure presents detailed information on how Dracco Airstream Conveyors have solved bulk materials handling problems. Write for Bulletin 530.

DRACCO *airstream* conveyors
dust control equipment

New Equipment

Write item numbers on Readers' Service Card to obtain more information.

Perforated steel sandpaper.

Steel Sandpaper-Scraper

The newest addition to plastics, wood, or rubber worker's tool kit is Dragon-Skin, a material which combines the flexibility and handling ease of sandpaper with the fast cutting characteristics of a wood scraper. A product of Red Devil Tools, it is made by punching 0.036-inch diameter holes in 0.04-inch thick sheets of steel. These holes are punched 150 to the square inch in a regular wave pattern.

Since the punching produces a five-sided burr, there are actually 750 cutting edges per square inch. Cutting action is said to be at least five times faster than conventional sandpaper, and gives a finish equivalent to medium grade sandpaper. Dragon-Skin can be wrapped around dowels for working concave surfaces, cut in strips for specialty jobs, or can be used in conventional sandpaper holders. Individual pieces measuring 4¼-by five inches are packed one to a box.

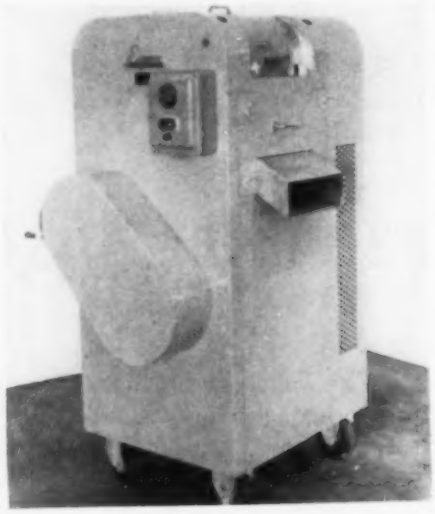
Readers' Service Item E-1

Portable Plastics Pelletizer

A portable plastics pelletizer for cutting extruded plastics strands into uniform-length pellets has been added to the product line of Frank W. Egan & Co. Designed primarily for laboratory use, the unit features a removable rotor cover and a pull-drawer type discharge chute to facilitate cleaning and internal assembly.

Four rotor-born, high-speed steel fly knives provide shearing action with an adjustable bed knife. The rotor, which is made from a solid steel forging, is supported by heavy duty pillow-blocks. Pull rolls, measuring 3½ inches in diameter by eight inches in length feed the strands through a nylon rotary bristle brush which straightens them prior to their entry into the cutter. The unit is geared to provide a speed range from 8-75 fpm. for ⅛-inch long cuts, and is equipped with three sets of change gears so that pellets of 1/16-, ⅛-, or 3/16-inch can be made. The rotor, rotor cover, chute, and all parts that come in contact with the plastic are made from stainless steel or are chrome plated.

The pelletizer is driven by a two-hp. Reeves variable speed drive motor, to which the start and stop buttons are prewired. A safety switch on the rotor cover is provided so that the motor cannot be started with the cover removed. Equipped with guards over the drive, the unit is caster-mounted and comes completely assembled and ready for operation.



Egan's 8-inch plastics pelletizer.

Readers' Service Item E-2

Diisocyanate Detection Kit

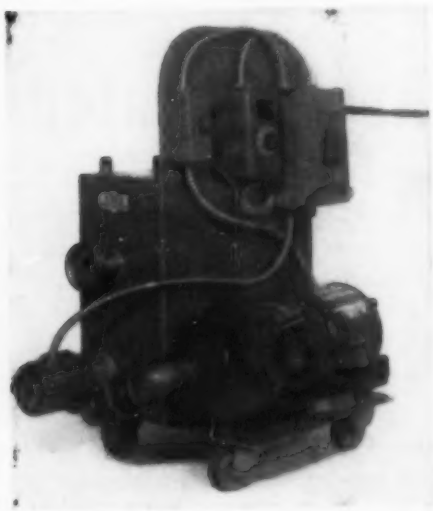
Present large-scale use of toluene diisocyanate in the manufacture of polyurethane foams has created a health hazard. It has been determined that vapor concentrations of TDI and TDI urea in concentrations above 0.1 ppm of air constitute bad industrial hygiene. Mine Safety Appliances Co. has developed a practical field kit for quantitatively determining their concentrations.

The kit itself consists of a hand-cranked four cylinder pump and regulator for drawing atmospheric samples at the rate of one liter per minute; three-minute timer for controlling the sampling period for each test; six, all-glass impinger tubes for absorbing TDI in dilute aqueous acid solution; replaceable reagents in polyethylene bottles; and comparison color standards representing concentrations of 0.05, 0.1, and 0.2 ppm. Case dimensions are 12 by 7¾ by 5½ inches.

Operating the pump for three minutes draws a three-liter air sample through 15 milliliters of acid solution in the impinger flask. Absorbed in the solution, the TDI hydrolyzes to an amine. Adding 15 drops of sodium nitrate-sodium bromide and mixing for 1½ minutes forms a diazo-amine compound which turns a rose pink upon the addition of 15 drops of N-1-naphthyllethylene diamine.

Portable diisocyanate-vapor detection kit

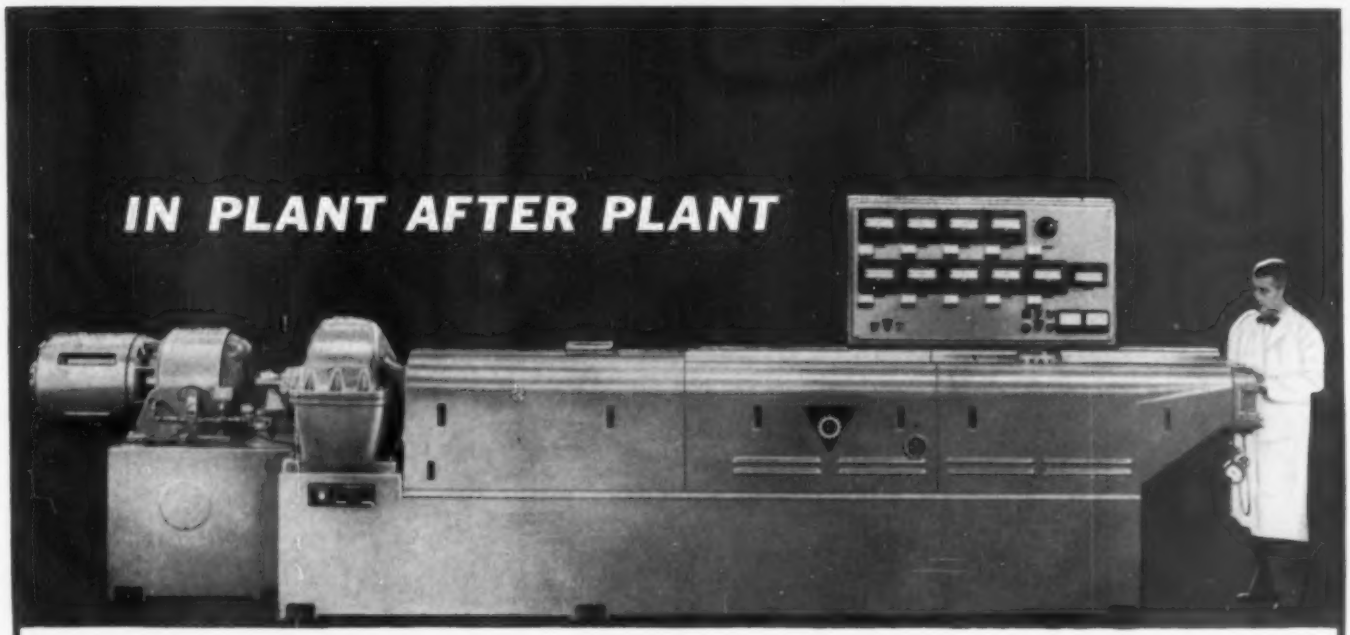
Readers' Service Item E-3



IMS' constant temperature circulator.

Mold Temperature Controller

The injection mold constant temperature circulator, made by Injection Molders Supply Co., is now available in a low-cost model that can be used with machines having capacities up to 24 ounces. Driven by a ¼-hp. motor, the circulating pump gives a water delivery of 20 gpm.



30 to 80% more production with PRODEX Extruders

PRODEX EXTRUDERS with VENT and VALVE L/D 24:1 and 30:1 outperform others in these jobs:

- **POLYSTYRENE SHEET** without predrying
- **HIGH DENSITY POLYETHYLENES** from powder feed
- **CABLE JACKETING** without porosity
- **CALENDER FEEDING** without banbury or mills
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- **DEVOLATILIZING** and continuous removal of monomers, moisture, entrapped air, etc.
- **GENERAL CUSTOM EXTRUSION** for close tolerances, no porosity, easy to operate

PRODEX NON-VENTED EXTRUDERS L/D 20:1 and 24:1 have set new standards of performance in precision and output rate when venting is not required.

- **FILM EXTRUSION** of polyethylene and vinyl
- **LAMINATING** plastic to plastic and paper coating
- **VALVED EXTRUSION,** interrupted for molding and continuous valving for dispersion and extrusion.

Package installations for sheet, film, pipe, wire and cable; continuous compounding and laminating. PRODEX EXTRUDERS are available in 1¾", 2½", 3½", 4½", 6" and 8" sizes

50 PAGE ILLUSTRATED BULLETIN E-3 GIVES COMPLETE DETAILS ABOUT PRODEX EXTRUDERS

PRODEX

PRODEX CORPORATION

FORDS, NEW JERSEY • HILLCREST 2-2800

Manufacturers of Process and Extrusion Machinery

IN CANADA: Barnett J. Danson & Associates, Ltd., 1912 Avenue Rd., Toronto 12, Can.

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—designed to give better protection from heat and light. Whether you are producing film, sheeting, floor tile or plastisols, there is a Metasap Stabilizer to do the job.

METASAP METALLIC SOAPS

—these proven compounds not only improve internal lubrication of molding powders, but act as plasticizers. When dusted on molds, they supply external lubrication and prevent sticking. They also permit molding at lower pressures, help speed the molding cycle, promote longer mold life, improve the finish of the end product.

★ ★ ★

Remember, whatever your needs, you will fill them best—fill them fast—through Metasap. Write for full information. Our Technical Service Department will gladly make recommendations based upon your specific requests. Metasap Chemical Company, Harrison, N.J.

VITAL INGREDIENTS FOR THE PLASTICS INDUSTRY

A subsidiary of NOPCO

Harrison, N.J. • Richmond, Calif. • Cedartown, Ga.
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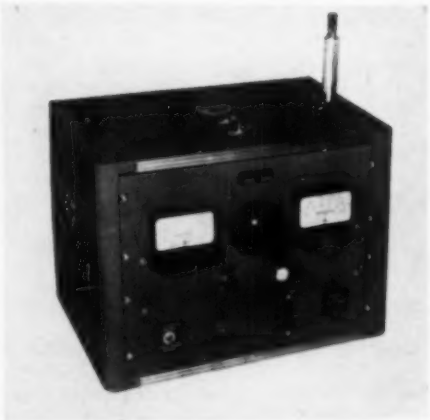
against a 23-foot head to handle greater loads than could be borne by the previously used ⅙-hp. pump.

This model utilizes a thermostatic control to add heat if the mold temperature drops, or remove heat if it climbs. The heater is a 4,500 watt unit equipped with an extra heavy duty relay, and the thermostat is designed to give temperature control from 50-200° F., although optimum service is said to commence at 70°. A built-in cooling coil is provided to reduce temperature, when necessary.

Occupying a floor space of 15½ by 22 inches, and standing 28 inches high, the lost cost model requires ⅜-inch water inlet and sewer connections; is caster mounted; wired for a 60-cycle, 220-volt, single-phase power source; and is stocked for immediate delivery. Other models using water or oil as the heat transfer medium are available on order.

Readers' Service Item E-4



ARI Model 5250 Hypot tester.

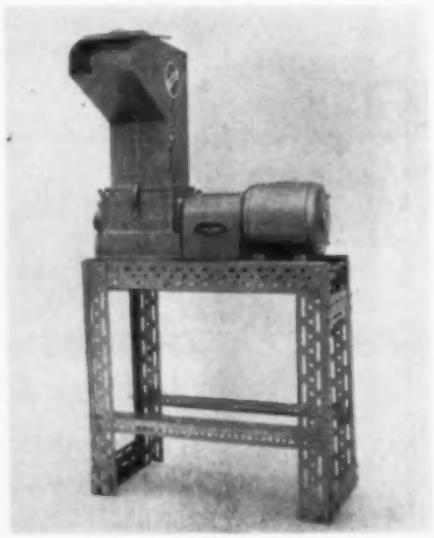
Insulation Tester

Model 5250, the first of a redesigned line of portable, bench-type, D.C. Hypots, is available from Associated Research, Inc. The new tester is designed for determining the HV insulation characteristics of electronic components, capacitors, plastics and other insulation materials, electrical equipment, etc., at voltages up to 30 KV. at 2.5 milliamperes d.c.

The new Hypot has an input of 115 volts, 50-60 cycle, single-phase, with a continuously variable output of 0-30,000 volts. The unit incorporates ARI Dual-Direct output metering with a 4½-inch kilovoltmeter and a 4½-inch electronically-protected microammeter calibrated 0-50/250/2500 microamps. Both the voltmeter and microammeter are direct connected in the output for greater accuracy. This feature permits simultaneous measurement of applied voltage and current for accurate plotting of insulation characteristic curves. The unit also is provided with ARI by-pass return and metered return terminals with a selective ground switch to facilitate elimination and/or measurement of surface and corona leakage currents during the test.

The unit is equipped with a 5¼-foot connector input lead having a ground clip and a standard two-prong plug. Controls include an on-off manually-reset circuit breaker and "on" pilot light; non-locking push switch and pilot light for "HV on"; variable output voltage control with zero start interlock; microammeter range switch; selective ground switch for grounding the return terminals that have Lucite bushings and ground switches. The tester is easily portable, and has a gray wrinkle finish with sturdy carrying handles at each end. Dimensions are: width, 21 inches; depth, 16 inches; and height, 18 inches. The unit has a net weight of 85 pounds.

Readers' Service Item E-5



IMS' constant temperature circulator.

Portable Sprue Grinder

A compact, large-throat portable grinder has been introduced by Injection Molders Supply Co. Called the Model M-1 Portable Sprue & Part Grinder, it is designed for use with the Van Dorn, Fellows, Moslo, Impco, and Watson 1-3 ounce machines.

Featuring a 6½- by seven-inch throat, the direct-drive unit is designed for bench mounting or for mounting directly on the injection machine to discharge into the press hopper or feed chute. It is especially useful with automatic machines to handle sprues and runners at a belt discharge point. No motor is furnished unless requested, but shaft size must be specified. The spot-welded hopper is reversible, and the machine is dismantled easily without the use of tools.

The grinder measures 14 by 27½ inches, and stands 37¼ inches high. It weighs 100 pounds. Optional equipment include a one-hp. motor, a floor stand, catch pan, flywheel and belt, starter, and heaters.

Readers' Service Item E-6

NEW

Mercury CADMIUM Red Pigments

Exemplary Stability in Plastics

Exceptionally Bright
Exceedingly Easy to Disperse
Excellent Permanence
Extra Economy

SAMPLES and further information will be gladly furnished on request.

MERCURY LIGHT RED Lithopone No. 480
MERCURY MEDIUM LIGHT RED Lithopone No. 490
MERCURY MEDIUM RED Lithopone No. 500
MERCURY DARK RED Lithopone No 510
MERCURY MAROON Lithopone No. 520

HARSHAW

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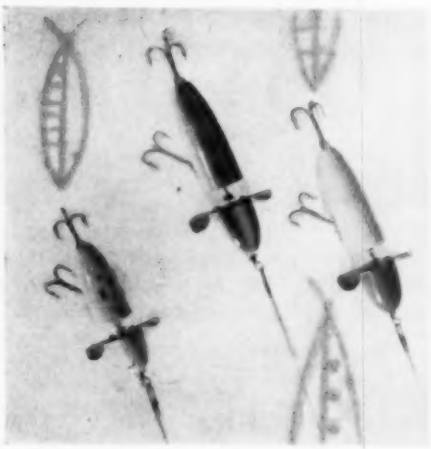
1945 East 97th Street • Cleveland 6, Ohio

Plastics Applications

Write item numbers on Readers' Service Card to obtain more information.



Miller Lures' butyrate spinners.

Butyrate Fishing Lures

A line of fishing lures featuring free-spinning heads for greater fish deception has been placed on the market by Miller Lures Co. Tradenamed Top-Kick, the lures are molded from Eastman Chemical's Tenite butyrate by Easley Plastics. Two sizes are available—¼ ounce and ½ ounce, and six colors or types: red head, yellow perch, black perch, black-gold spots, yellow-gold spots, and frog.

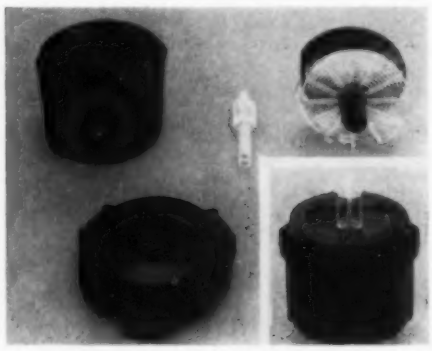
Miller reports that the butyrate plastic used for the lures will withstand easily the heat generated in tackle boxes and auto trunks. It fuses with a special paint developed by the firm to form a nearly indestructible finish. The lures are packaged in individual, transparent plastic boxes or on display cards of one dozen.

Readers' Service Item P-1

All-Styrene Developer Tank

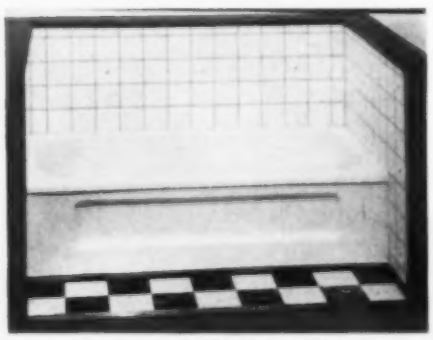
The new Anscomatic, self-loading developing tank recently put on the market by General Aniline & Film Co.'s Ansco division contains four different Styron (Dow polystyrene) formulations. Styron 700, black, is used for the body to insure complete opacity and high-gloss finish. High-impact Styron 475 is used for the lower reel flange and shaft, which are agitated during the developing process.

The transparent, upper reel flange, molded from Styron 666, allows the second exposure of color film without removal from the tank. The agitator rod is Styron 689, a general purpose formulation with excellent moldability. A thermometer is built into this rod. The molder for all four parts was Consolidated Molded Products Corp.



Styrene components of the Anscomatic developing tank and the assembled tank.

Readers' Service Item P-2



Fiberglas-reinforced polyester bathtub.

Reinforced Plastic Bathtub

A Fiberglas-reinforced polyester bathtub weighing about 1/10 as much as an ordinary fixture has been introduced by Sani-Glas, Inc. Two sizes are available: the 46½-inch model which weighs 18 pounds; and the 54-inch tub, which weighs 25 pounds. All standard colors are available.

The Fiberglas finish is integral, and will not chip or mar. It will not take on cold regardless of the area of the house in which it is installed. The tub reportedly cleans easily, and is unaffected by household chemicals and cleansers.

Readers' Service Item P-3

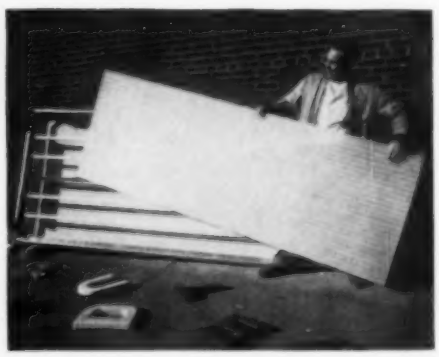
Insecticide unit features built-in plastic aerosol sprayer.

Sealed-In Aerosol Sprayer

Development of a polyethylene inner seal has made possible the marketing of an insecticide dispenser with built-in aerosol sprayer. Used by Real-Kill Co. for its Real-Kill Bug Killer, the insecticide package has a leak-proof polyethylene cap which fits snugly over the spray unit when not in use. The bottle itself is of amber glass.

Improved sprayer design is said to provide five times more pressure at the nozzle, resulting in greater fogging action. It reportedly sprays twice as far and gives a third more coverage at less cost. Orifice pressures up to 100 pounds have been reported. Bakan Plastics molds the sprayer unit.

Readers' Service Item P-4

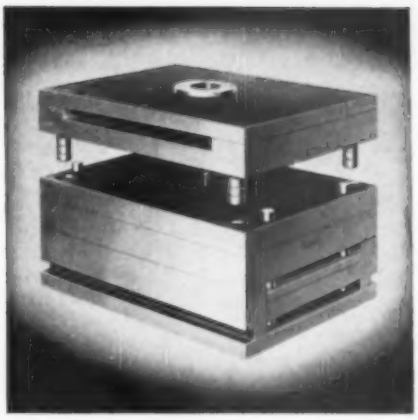


Cadillac's extruded, corrugated acrylic sheeting.

Corrugated, Extruded Sheet

Extruded, corrugated acrylic sheet is now available from Cadillac Plastic & Chemical Co. Substantially lower in cost than cast sheet, the new material has the same optical, weathering, and chemical properties. Expected applications include sign facings, displays, office and shop partitions, greenhouses, and other glazing ap-

Here's your answer to rising costs



HOW D-M-E STANDARD MOLD BASES CAN KEEP YOUR MOLD COSTS DOWN DESPITE RISING COSTS OF STEEL, LABOR AND TOOLS

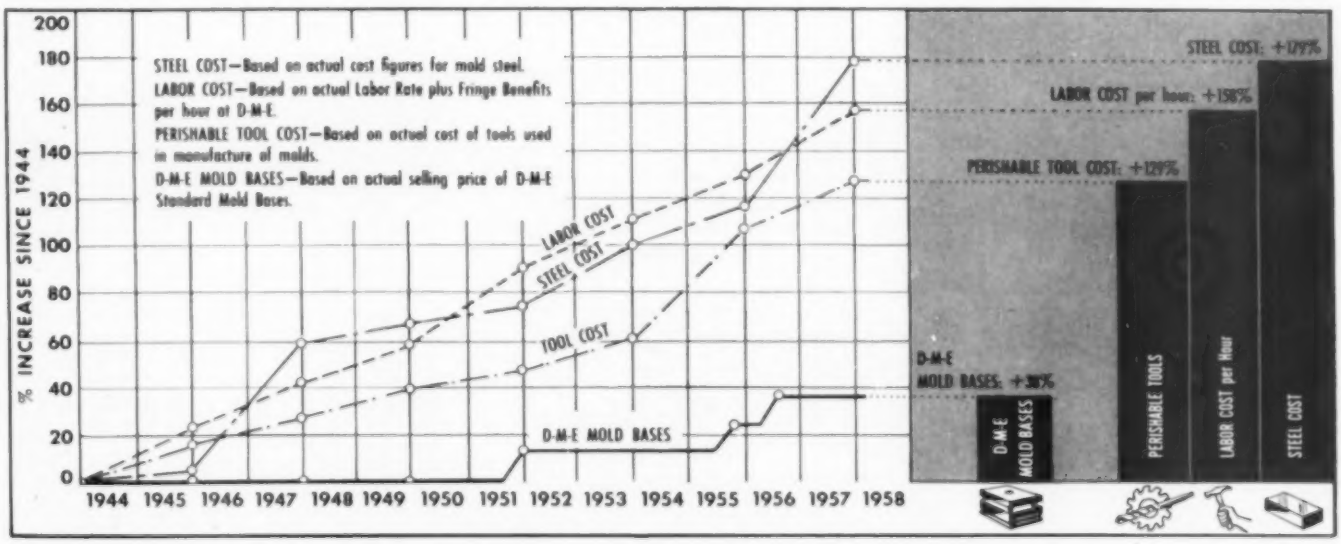
Whether to make or buy an industrial product is one of the most important decisions any manufacturer continually faces. To accurately judge the economy in D-M-E Mold Base standardization, basic cost factors were analyzed dating back to the origin of Standard Mold Bases by D-M-E over 15 years ago. The analysis is plotted on the graph shown below. How these factors affect the cost of the mold is what makes the important difference in whether to make or buy Standard Mold Bases.

Since 1944, the cost of steel has increased 179%; the hourly cost of labor has climbed 158% and the cost of perishable tools has gone up 129%! In the same period the net selling price of D-M-E Standard Mold Bases has increased only a fraction of these amounts.

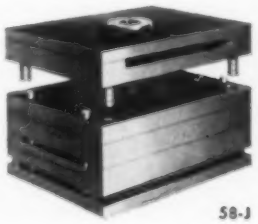
For the mold builder making his own mold bases throughout this period, rising steel, labor and tool costs are reflected in the increased cost of his own finished molds. The savings to the mold builder who long ago recognized the advantages of Standard Mold Bases, become immediately obvious.

The company using D-M-E Standard Mold Bases today not only saves money NOW, but can rely on a more stable cost factor for anticipated mold building programs. At the same time investment capital is freed for equipment more suited to special requirements.

Why it costs less to buy D-M-E standard mold bases than it does to make your own



WRITE FOR the April issue of the D-M-E News giving complete details on "How to reduce mold costs". Or contact your nearest D-M-E Branch for the 170 page Catalog of Standard Mold Bases and Moldmakers' Supplies. Start saving Now!



58-J

DME

DETROIT MOLD ENGINEERING COMPANY

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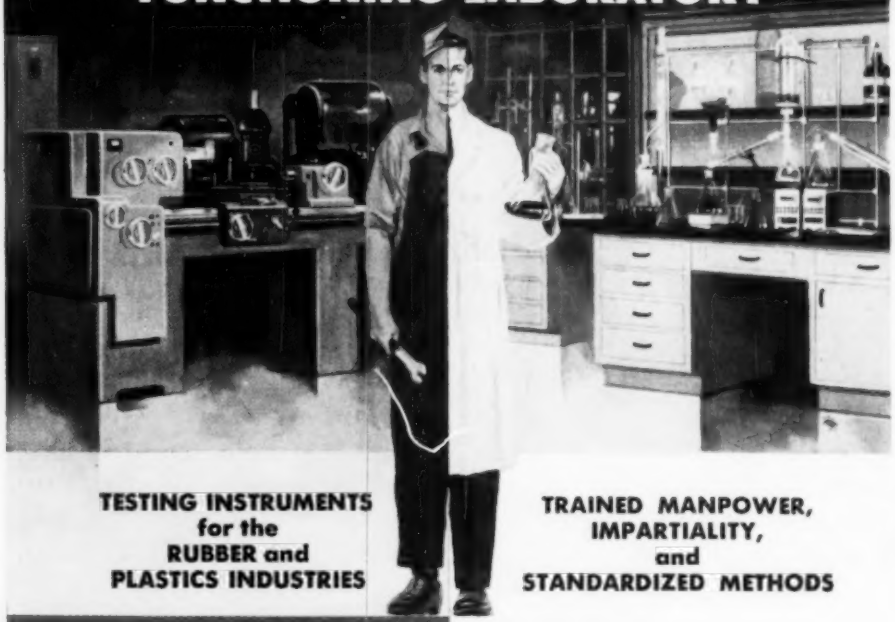
- D-M-E of CANADA, TORONTO, ONT.: 156 Norseman Ave.

SCIENTIFIC TESTING INSTRUMENTS MADE BY A FUNCTIONING LABORATORY



TESTING INSTRUMENTS for the RUBBER and PLASTICS INDUSTRIES

TRAINED MANPOWER, IMPARTIALITY, and STANDARDIZED METHODS

We Make Them More Efficient Because We Use Them, Too!

As the only functioning laboratory manufacturing instruments, we harness the talents of the laboratory and the instrument technicians. Result: the instruments are conventional in operation, simple to calibrate, easy to maintain. They are sensitive, stable, and, in most cases, applicable to multi-purpose testing requirements. And all are pre-tested in our own laboratories.

Our instrument service is four-fold: we design and manufacture new instruments; we modify existing instruments to meet special needs; we manufacture instruments from existing designs; we operate new instruments where impartial laboratory reports are essential. Write for our free Instrument Service Bulletin.

Carver-Washington Stiffness Tester for pliable sheet forms

Universal Pendulum Impact Tester

Three Vital Contributions of the Independent Laboratory to RUBBER and PLASTICS TESTING

In so fluid and expanding a field as Rubber and Plastics, the problem of testing and research remains acute for the individual manufacturing concern.

The United States Testing Co., with its comprehensive laboratory facilities, offers such concerns important technological services in such timely aspects as:

1. Release of your valuable technical manpower to more creative efforts in more fruitful fields by assumption of the burden of your time-consuming projects.

2. Application of standardized methods to Rubber and Plastics tests for more valid comparisons of material properties, manufacturing processes, and end-use performance.

3. Impartial findings in all phases of Rubber and Plastics testing, offering both an invaluable objective viewpoint and a check against your own test results.

UNITED STATES TESTING COMPANY, INC.

Established 1880

1640 PARK AVENUE, HOBOKEN, NEW JERSEY

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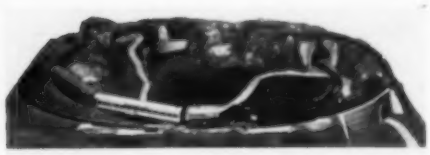
plications where the extra rigidity of corrugations is a factor.

Standard widths of 35½ inches are provided with interlocking edges, so that the sheets may be linked to any desired width without a break in corrugation. Flat and ⅜-inch wide, the corrugated ridges provide firm anchorage for sign letters and display elements. Standard lengths are 36, 48, 72, and 96 inches; however, lengths up to 25 feet are available on special order. Standard colors are white, in two degrees of translucency.

Readers' Service Item P-5



Three-dimensional plastic layout for model trains.

Panoramic Model Train Layout

A light-weight, three-dimensional layout for HO-gage train sets is available from Blackman Plastics, Inc. Called the Western Mountain Layout, it is vacuum-formed in one operation from 40-mil Campco S-540 rubber-modified styrene sheet. The prefabricated "terrain" measures 42 by 48 inches, and includes mountains, gullies, reservoir, and tunnels.

Designed for 18-inch radius track, the layout has a reinforced, laminated base cut out on the underside to allow easy wiring. Tracks and switches fit snugly in precision-formed grooves, and provision has been made for retailers, uncouplers, and run-off for combining two or more layouts. Dam face, roadbeds, trestle, and tunnel entrance are off-white; mountains, tunnels, lakes, rivers, and reservoirs are hand colored and flocked for realism and authenticity. Shipping weight is about 13 pounds.

Readers' Service Item P-6

Embossed, Perforated Mylar

One of the more attractive plastics application seen recently is a "woven" Mirro-Brite Mylar sheeting available from Coating Products, Inc. The firm metallizes the DuPont polyester film, laminates it to 12-gage vinyl film, embosses it, and perforates it 240 times to the square inch. A current application for the material is on the grill of hi-fi equipment, TV sets, and other products requiring interstices.

The firm's Mirro-Brite line consists of 0.5 mil metallized Mylar laminated to such backings as 4-18 mil unsupported vinyl, vinyl-coated fabrics of all constructions, and latex-impregnated paper. Gold, silver, or copper is plated to the film, and

this side is applied to the backing so that the finish is protected by the tough Mylar film.

Mirro-Brite laminates are produced in 54-inch wide rolls, where a pressure-sensitive adhesive backing is not required. Should this backing be specified, rolls are 27 inches wide and can be split into webs with a width limitation of 5/8 inch.

Perforated metallized Mylar is both durable and attractive.

Readers' Service Item P-7

Futura melamine ash trays.

Molded Melamine Ash Trays

The first ash tray to be molded from melamine has been placed on the market by Dale Chemical Co. Called the Futura, the colorful tray incorporates cigarette snuffers and a non-tipping feature as basic parts of the design. Although it looks fragile, the tray is virtually unbreakable, burn proof, and will not blister.

When not in use, the trays stack easily as the base of each fits into the snuffer grooves of the tray beneath it. Available colors are Flamingo Red, Turquoise, Charcoal, and Cloud White. Melamine used in this application is Plaskon, a product of Allied Chemical Corp.'s Barrett division.

Readers' Service Item P-8

40% greater impact strength

PLENCO 466 H. R. BLACK

Resists heat of 450° F. over long exposures with, however, added impact strength, which—in the case of 466—is .42 ft. lbs. per inch of notch compared to .30 of ordinary heat resisting formulations. That's a 40% increase, and most valuable when considering the shock and abuse to which appliances, for example, are subject.

extra-low specific gravity

PLENCO 485 H. R. BLACK

Gaining wide acceptance on applications where 400° F. over long exposure is adequate. Possesses a specific gravity of only 1.45, unusually low for a heat resisting material. Not only can more pieces per pound be made with Plenco 485, but the formulation is easy on the molds because of its extremely low mold erosion characteristics.

MANUFACTURERS OF APPLIANCES and electrical parts will find these two new Plenco-produced compounds advantageous when higher than general purpose heat resistance and impact strengths are required.

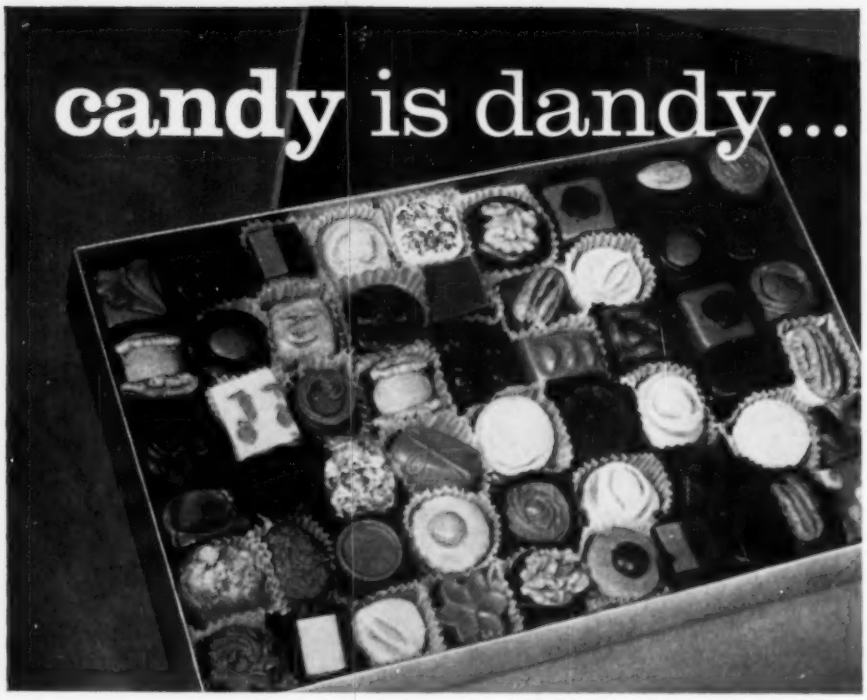
In addition, both Plenco materials have excellent moldability, giving high gloss surface finish with a fast, rigid set, and low shrinkage essential for efficient production. Detailed data sheets are available upon request. So is consultation with our technical staff about your particular molding problem. If phenolics is the answer . . . Plenco can provide it.

PLASTICS ENGINEERING COMPANY

Sheboygan, Wisconsin

PLENCO PHENOLICS
FOR BETTER PLASTIC PRODUCTS

Serving the plastics industry in the manufacture of high grade phenolic molding compounds, industrial resins and coating resins.



but for display purposes,

Replicas made with

A-C® Polyethylene are better!

It looks exactly like the real thing—but it isn't! Even placed side-by-side with a box of real candy, the exact copies are indistinguishable from actual candy. Made by Knechtel Laboratories of Chicago, they are used for display purposes by many of the nation's leading candy manufacturers. Other perfectly detailed replica work is done by Knechtel on meats, fruits and vegetables. And A-C Polyethylene is *the* basic ingredient in *all* of these items.

This is just one example of the many opportunities this new technique of slush molding with low-viscosity A-C Polyethylene offers. Profitable short runs are now possible because of low mold cost and low initial investment in equipment. Your engineers can design more detailed objects, which can then be executed by cheaper mold processes. A wide variety of part sizes and shapes is possible, too, ranging from small pieces like the candy above to 50-ounce parts. You can transfer to slush molding many of the parts now injection molded, doing it better, faster and more economically with A-C Polyethylene blends. These blends create an *entirely new material,* one that can be tailor-made to fit your needs. Wall thickness and finish can be controlled while maintaining faithful mold reproduction.

Polyethylene slush molding lends itself to hand pouring operations or semi-automatic and automatic machines at low pressures because of the low-viscosity characteristic of the A-C Polyethylene used. Whichever method you adopt, equipment and costs are surprisingly low.

You owe it to yourself to carefully consider this new, profitable process. Write *today* for full information, specifying your intended use of A-C Polyethylene. It helps us to help you.

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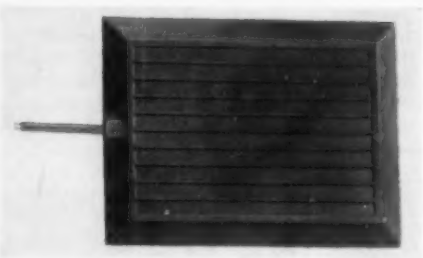


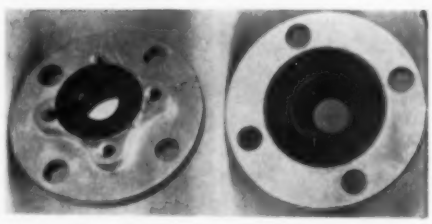
Neptune foot switch's electrodes are imbedded in vinyl for corrosion resistance.

Vinyl Electrical Foot Switch

A completely waterproof foot switch for use on electrical equipment in wet, oily, or dusty environments has been introduced by Recora Co., Inc. Called the Neptune, the switch features electrodes embedded in flexible vinyl for complete safety and sanitary maintenance.

Measuring six by eight inches, the Neptune allows repetitive foot operation without searching. Its extreme thinness—less than ½ inch—permits fatigue-free operation. The switches are available in four colors: brown, blue, green, and gray.

Readers' Service Item P-9



Fluoroflex-T, tapered reducing flange.

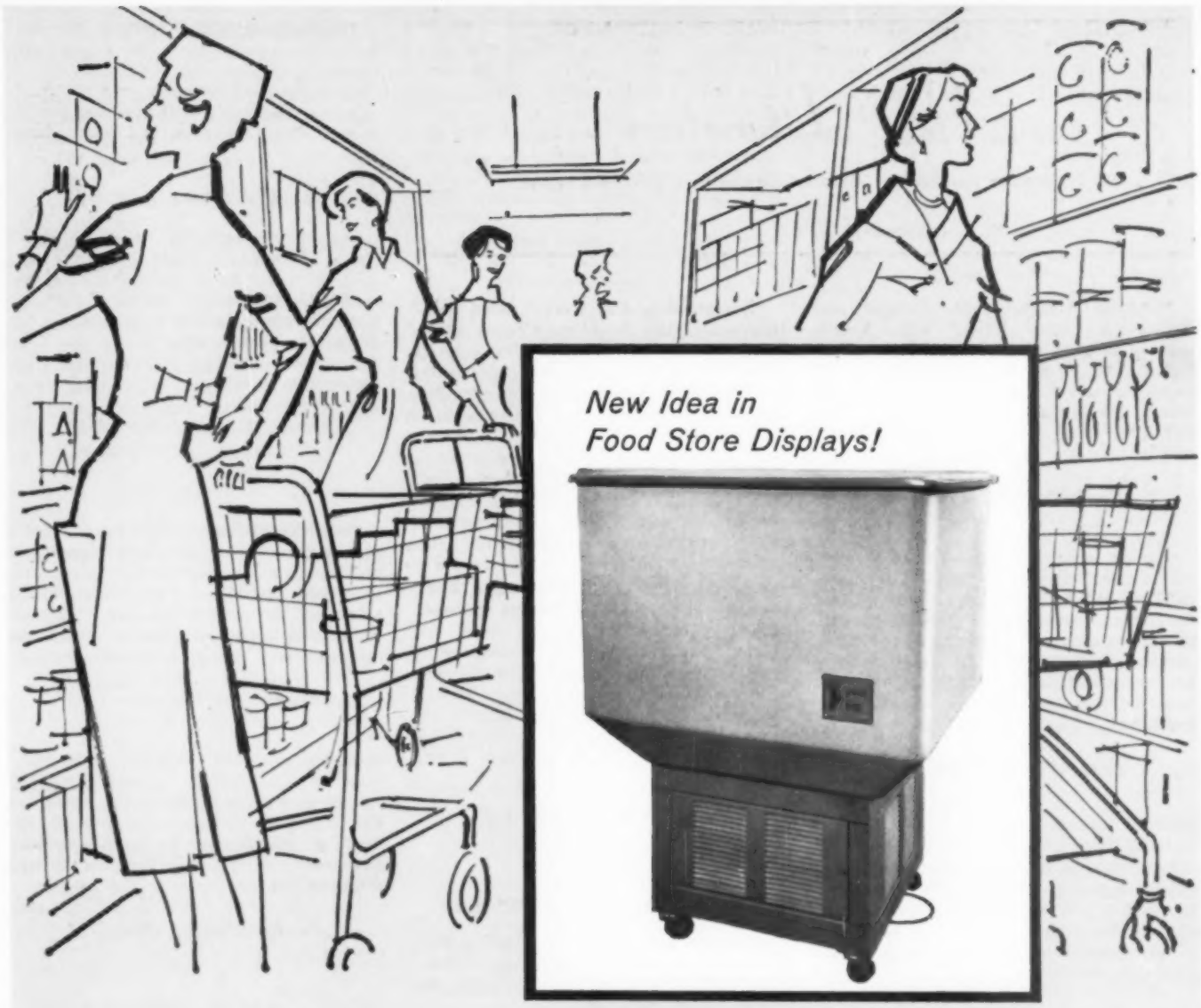
Teflon-Lined Reducers

Teflon-lined, tapered, reducing flanges have been added to the Fluorflex-T, Type S series of corrosion proof pipes and fittings produced by Resistoflex Corp. The seamless, semi-flexible liner is not damaged by thermal shock and is resistant to nearly all industrial chemicals.

In addition to covering the inner surfaces of the tapered orifice, the Teflon coating extends over the entire bearing surface of the flange to form an integral, asbestos-backed gasket.

Standard housings have a 150-lb. rating; are made from ductile iron; and will operate under full pressure or vacuum at temperatures ranging from —100° to +500° F. Flange dimensions and bolt circles are A.S.A. standard; and the 45° and 90° ells have short-radius housings. The units are available in eight sizes, ranging in maximum diameter from six inches down to 1½ inches.

Readers' Service Item P-10



Extra strength and eye appeal in "**Polar Bar**" built with

RCI POLYLITE POLYESTER RESINS

A traffic stopper like this portable freezer display must be rugged enough to endure frequent shopping cart collisions . . . yet attractive enough to appeal to supermarket patrons.

Polar Bar Inc. of Athens, Georgia, solved this dual need by constructing their freezer display case of RCI POLYLITE resins and fibrous glass. "The result is a box that is not only strong, durable and lightweight," states George A. Watson, production manager of the company, "but also one that is permanently colorful because the color is an integral part of the case itself.

"Two POLYLITE polyester resins are used. One *contains the color pigment* which is sprayed into a mold to form the outside shell. Afterwards, another is used to impregnate the spun glass mat within this shell, adding great strength to the finished unit.

"POLYLITE resins have proved the perfect materials for our process...but just as important has been the production advice received from our Reichhold representative! Thanks to him, a costly trial and error period was avoided, and production of our high quality units was speeded."

Perhaps POLYLITE polyester resins can improve *your* product. Why not discuss the matter more fully with your RCI representative?

Synthetic Resins • Chemical Colors • Industrial Adhesives • Phenol
Hydrochloric Acid • Formaldehyde • Glycerine • Phthalic Anhydride
Maleic Anhydride • Sebacic Acid • Ortho-Phenylphenol • Sodium Sulfite
Pentaerythritol • Pentachlorophenol • Sodium Pentachlorophenate
Sulfuric Acid • Methanol

Creative Chemistry... Your Partner in Progress

REICHHOLD

REICHHOLD CHEMICALS, INC.,
RCI BUILDING, WHITE PLAINS, N.Y.

New Literature

Write item numbers on Readers' Service card to obtain copies.

"Vulcoid Sheets, Rods, Formed and Fabricated Parts." Folder V-58. Continental-Diamond Fibre Corp. 4 pages. This intermediate insulation is made from resin-impregnated vulcanized fibers. Tables and charts give mechanical and dielectric strengths, plus data on arc resistance, tensile strength, and shear.

Readers' Service Item L-1

"Tyril 767." 171-83. Dow Chemical Co. 8 pages. Properties, applications, and processing data are given for this styrene-acrylonitrile copolymer. It is said to have an excellent balance of physical properties, and a wide range of chemical resistance.

Readers' Service Item L-2

"An Inexpensive Hopper Dryer for Small Injection Machines." Thoreson-McCosh, Inc. 1 page. This illustrated flyer describes the unit, which can be used with machines having a capacity up to four ounces.

Readers' Service Item L-3

"Hardman Triplematic Pumps." H. V. Hardman Co. 4 pages. This illustrated folder describes the firm's line of pumps which can be used to dispense and meter shots of resin and hardener, or any two-part resin compound.

Readers' Service Item L-4

"Pre-Compressed Molding." W. R. Grace & Co., Polymer Chemicals division. 16 pages. Operating techniques and specific advantages of this technique (valve-gating) are described and illustrated in this bulletin. Schematic drawings show how the material is compressed in the heating chamber; valve gates open to permit the material to enter the mold cavity; the valves close; the injection piston applies pressure to the next shot as the part is cooling; and the mold opens to eject the finished piece.

Readers' Service Item L-5

"Compression and Cavity Mold Sets." National Tool & Mfg. Co. 6 pages. Specifications and schematic drawings are given for the 6 by 11⅛ inch and the 13 by 15 inch compression mold sets; plus specifications for the 6 by 10 and 6 by 11⅛ inch cavity plate sets.

Readers' Service Item L-6

"Novel Features in National's Compression Mold Sets for Stokes Presses." National Tool & Mfg. Co. 2 pages. Explained herein are the firm's compression mold sets for the Stokes Model 800 and Model 741 automatic molding presses. National's flexible standards permit the molder to use a standard compression mold set in any of five different spacer block heights.

Readers' Service Item L-7

"Maraset Flexible Resin #639." Marblette Corp. 1 page. Properties, applications, and formulations are given for this epoxy casting material.

Readers' Service Item L-8

"Polyethylene Flamenol Control Cable." No. 19-467. General Electric Co., Wire & Cable department. 4 pages. This bulletin gives detailed information on the construction and applications of the cable, which can be installed in wet or dry locations, aerially or buried. Test data is given for the polyethylene insulation as well as the double PVC jackets.

Readers' Service Item L-9

"Carbowax Polyethylene Glycols." Union Carbide Chemicals Co. 54 pages. Properties, applications, storage, and testing of these materials are covered in this booklet. They are used in water-soluble lubricants, cosmetics and ointments, emulsifying agents, adhesives, and paper coatings.

Readers' Service Item L-10

"Hy-R-Speed Mills." Bulletin No. 1057. J. H. Day Co. 4 pages. The firm's equipment line is described and illustrated in this bulletin. The mills are used for grinding, dispersing, and blending plastics, paints, inks, lubricants, and other chemicals.

Readers' Service Item L-11

"Plastic Laboratory Supplies." Cat. No. E956. General Scientific Equipment Co. 16 pages. This catalog covers the firm's line of polyethylene, polyurethane, PVC, and nylon lab-ware.

Readers' Service Item L-12

"Facilities Bulletin." Insulation Mfg. Co. Inc. 8 pages. Through plant photos, the brochure outlines the firm's molding facilities and products. The latter include electrical switchgear components, electronic and radio components, instrument housings, and special applications.

Readers' Service Item L-13

"The Acromark Catalog." 9A. Acromark Co. 6 pages. Included are data on the firm's peripheral marking machines which hot-stamp calibrations with a flat die and slide motion.

Readers' Service Item L-14

"Facts About Plastics." Cadillac Plastic & Chemical Co. 4 pages. The pamphlet compares properties and industrial applications of 11 major plastics in common use.

Readers' Service Item L-15

"In Playthings It's Vinyl and in Vinyl It's Marvinol." Naugatuck Chemical division, U. S. Rubber Co. 4 pages. Essentially a pictorial presentation of vinyl toys with emphasis on the firm's Marvinol vinyl resins.

Readers' Service Item L-16

"Sturtevant Micronizer Grinding Machine." Bulletin No. 091. Sturtevant Mill Co. 4 pages. The bulletin describes fluid energy grinding, and includes a cross-sectional drawing of the Micronizer. Sizes, pressure requirements, and capacities are tabulated.

Readers' Service Item L-17

"The Case of the Insidious Insulators." Mesa Plastics Co. 8 pages. This brochure explains failures caused by plastic insulator deterioration. Investigations were conducted under conditions of high temperature and humidity.

Readers' Service Item L-18

"Epoxy Alloy." Bakelite Co. 8 pages. Three alloys are described along with their applications: ES, an epoxy mass casting reinforced with steel fibers and surfaced with an epoxy steel fiber-flocked face coat; EG-SF, an epoxy mass casting reinforced with glass fibers and surfaced as ES; and EA, an epoxy mass casting reinforced with aluminum fibers and surfaced with an epoxy aluminum fiber-flocked face coat.

Readers' Service Item L-19

"A Rational Approach to Air Pollution Legislation." Manufacturing Chemists' Association. 20 pages. A second edition, this booklet defines the precepts and principles essential to air pollution legislation, and outlines step-by-step procedures for formulating such laws.

Readers' Service Item L-20

"PE-175 ES-1000 Plastics Injection Molding Machine." Bulletin 626-A. Watson-Stillman Press division, Farrel-Birmingham Co., Inc. 6 pages. Features and specifications of this preplasticizing type machine are listed, and a large photograph is included which labels all the principal parts.

Readers' Service Item L-21

"Plastic Laboratory Supplies." Cat. No. F957. A. Daigger & Co. 16 pages. Polyethylene, polyurethane, PVC, and nylon laboratory items are described and illustrated in this booklet.

Readers' Service Item L-22

"Mini-Jector Plastic Molding Machines." Newbury Industries, Inc. 38 pages. Specifications and descriptions for the firm's entire line of small injection molding machines are given, along with pictures, diagrams, and product photographs. Accessory equipment is described and illustrated.

Readers' Service Item L-23

"Information on Inhibition and Storage of Ethyl Acrylate and Methyl Acrylate." Rohm & Haas Co. 7 pages. Data is given on inhibiting polymerization of these monomers, and forms for both regular and low inhibitor grades are discussed. Both materials will undergo spontaneous polymerization without their addition, with subsequent dangers of explosion and other undesirable effects.

Readers' Service Item L-24

"Castor Oil Products for Urethane Polymers." Tech. Bulletin No. 31. Baker Castor Oil Co. 24 pages. Properties and applications of refined castor oil and such derivatives as triglycerides, esters, hydroxy acids, and emulsifiers are discussed. Several pages are devoted to applications such as prepolymers, rigid and semi-rigid foams, flexible foams, elastomers, coatings, and adhesives.

Readers' Service Item L-25

"Polysulfide Polymers—Aluminum Filler Study." No. 2-58. Thiokol Chemical Corp. 8 pages. The evaluation covers 14 aluminum materials of which three are recommended for use in formulating aluminum-colored building sealants. Other results indicate that five calcium carbonate-type materials can be used as fillers for low-cost, light-colored sealing compounds. Additives for improving their adhesion to glass, and agents for masking the polysulfide odor also are listed.

Readers' Service Item L-26

"Delhi-Taylor Petrochemicals." Chemical division, Delhi-Taylor Oil Corp. 4 pages. This product specifications folder lists nitration-grade benzene and toluene, 5° xylene, high aromatic solvents, and mineral spirits.

Readers' Service Item L-27

"Vinyl-Nitrile Rubber Study." Kenrich Corp. 7 pages. The use of Kenflex A as a mutual solvent and flux for vinyl-nitrile rubber combinations is described in this bulletin. Comparison tables are given, along with the ozone resistance figures for several compounds.

Readers' Service Item L-28

"A New Approach to the Measurement of Mass." Cahn Instrument Co. 4 pages. The Cahn portable Electrobalance is described and illustrated in this bulletin.

Readers' Service Item L-29

"Products of Atlas." Atlas Powder Co. 16 pages. This illustrated booklet describes the company's products and facilities.

Readers' Service Item L-30

"Hysol Tooling Plastics." Tooling #21. Houghton Laboratories, Inc. 10 pages. This bulletin describes the process of making tooling from epoxy laminates using the firm's resins and hardeners. Physical properties of the resins and laminates are listed.

Readers' Service Item L-31

"Accessory Fixtures for Dillon Model L Tester." 16-B. W. C. Dillon & Co., Inc. 2 pages. This illustrated flyer describes the firm's gripping fixtures for its universal testing machines.

Readers' Service Item L-32

"Inductomatic." Electrophysical Engineering Co. 6 pages. The special features offered by the firm's line of induction heated extruders are pointed out in a three-page schematic drawing. Other data include two recorded pyrometer curves for an EPE and a conventional resistance-heated extruder, plus photos of typical units.

Readers' Service Item L-33

"Plaskon Coating Resins." Barrett division, Allied Chemical & Dye Corp. 24 pages. Description, performance characteristics, and tests deal with oil-modified alkyd coating resins, rosin- and phenolic-modified alkyds, and alkyd copolymers. Information is given also on urea and melamine coating resins, silicone-alkyds, modified phenolic resins, maleic resins, ester gums, and pure phenolics.

Readers' Service Item L-34

"Molder's Guide to Injection Molding Grex High Density Polyethylene." Polymer Chemicals division, W. R. Grace & Co. 14 pages. Fundamental molding characteristics are discussed along with recommendations for part and mold design and molding machine selection. Proper cylinder and mold temperatures, injection pressures, and speeds are given, along with a molding problems check list. The valve-gating technique is described in considerable detail.

Readers' Service Item L-35

"Fabricator's Guide to Extruding Grex High Density Polyethylene." Polymer Chemicals division, W. R. Grace & Co. 8 pages. The use of this material in a number of extrusion techniques is discussed, along with the manufacture of film, sheet, tubing, monofilament, paper coating, profiles, and shapes.

Readers' Service Item L-36

"Buflovak Processing Equipment." Catalog 380. Buflovak Equipment division, Blaw-Knox Co. 24 pages. This catalog describes and illustrates the company's chemical-, food-, and by-product processing equipment; giving specifications for such items as evaporators, drums, rotary and vacuum dryers, flakers, cooling drums, processing kettles, and pilot plant equipment.

Readers' Service Item L-37

Book Reviews

"Metallurgical Progress-3." Philosophical Library, Inc., 15 East 40th St., New York 16, N. Y. Cloth, 8½ by 11¼ inches, 88 pages. Price, $6.00.

The third in a series of critical reviews, this work comprises a compilation and analysis of published information by seven authorities. Though not of interest to all plastic processors, there are a number of pertinent sections on testing plus a chapter on "Foundry Sand Practice." This chapter covers shell molding, shell cores, modifications of the shell molding process, the carbon dioxide process, investment casting, and modifications of the lost wax process. High pressure molding, dry sand molding, core practice, and sand recovery are also covered.

The chapter on "Non-Destructive Testing" covers surface conditions, ultrasonic testing, magnetic sorting, penetrating liquid methods, and radiography. Other chapter heads are: "Refractories in the Iron and Steel Industry," "Metallurgical Coke," "Reducing the Phosphorus Content of Foundry Iron," "Ironfoundry Metal Melting Furnaces,"and "Mechanical Properties of Flake Graphite Cast Irons."

"Plastic Tooling Symposium." Cosponsored by American Society of Tool Engineers and Society of the Plastics Industry. ASTE Technical Papers, 10700 Puritan Ave., Detroit 38, Mich. Plastic, 8½ by 11¼ inches, 48 pages. Price to ASTE members, $3.00; to non-members, $6.00.

The symposium was a direct outgrowth of the plastic tooling research project conducted at Purdue University under the auspices of ASTE's Research Fund Committee. The work includes eight technical papers, plus a panel discussion covering four separate lectures. Five other papers presented at the 1955 and 1956 annual meetings are included. All are profusely illustrated with photographs, schematic drawings, and tabular data.

Titles of the papers are as follows: "What Are Plastics?" "What Properties Are Available in Plastics" "History of Plastic Tooling," "Fabrication of Plastic Tools," "Tool Applications of Plastic Materials," "Known Limitations of Plastic Tooling," "Can Plastic Tools Be Repaired and Modified," "Control of Physical Properties," "Plastic Tools in Service," "Plastic Tooling for Small Parts," "Experiences with Plastic Tooling in the Stamping Plant," "Polyamide Resin Alloys in Practical Tooling Applications," and "Plastic Tooling for Production."

"Anthologie des Brevets sur les Matieres Plastiques, Fabrication et Transformation." (Anthology of Patents in Plastics, Their Manufacture and Transformation.) Volume I (1791-1930), No. 3. Jean Delorme. Published by Editions Amphora, Paris, France. Paper, by 9½ inches, 248 pages. Price, 1,600 francs.

In collaboration with the French publication, "Officiel des Matieres Plastiques," Jean Delorme has undertaken the collection of all patents on plastics issued since 1791. The present book is the third and last part of Volume I, covering the period 1791-1930. It consists of sections VI-XII, chapters 43-88, and covers aldehyde and ketone resins; resins derived from acids and their esters (such as colophony, derivatives of tall oil, copals, natural gums and resins); acrylic and alkyd resins; phenolics; amino resins; protein plastics (from fish scales, casein, gelatine, leather waste, blood, fish waste, silk, keratine, yeasts, bones, shells, etc., and vegetable proteins); resins derived from heterocylic compounds; and plastics with inorganic skeletons.

"Rapid Detection of Urea- and Melamine-Formaldehyde, Isocyanate, and Urethane Resins in Coatings." M. H. Swann, Aberdeen Proving Ground, U. S. Army. Order PB 131292 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 7 pages. Price, 50¢.

Rapid, qualitative tests for the above-named resins have been developed. Ureas and melamines in modified alkyds or other coating vehicles are identified simultaneously by refluxing with a mixture of acetic acid and anhydride containing a small amount of p-dimethylaminobenzaldehyd. Isocyanate and polyurethane resins are identified by the same reagent in glacial acetic acid.

"Technical Report Writing." James W. Souther. John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Paper, 8¼ by 10¾ inches, 70 pages. Price, $2.95.

This work covers the principles of engineering design in terms of writing-up solutions to specific problems. It stresses the factors a writer must consider and the processes he must follow in writing a report. Report form is related to its use, and report layout becomes a design tool which graphically covers the material contained therein.

Chapter I is introductory, and each of the following four chapters treats one stage in the design approach to technical writing. The second chapter analyzes the writing situation; determining the purpose, industrial use, and audience of the report. Chapter III covers the gathering of necessary material and its evaluation. Organization of the report itself is covered in Chapter IV, along with the proper order for reporting results. The fifth and final chapter covers the actual writing, checking, and modifying of the final copy.

"Windows and Glass in the Exterior of Buildings." Publication 478. Building Research Institute, 2101 Constitution Ave., Washington 25, D. C. Paper, 8½ by 11 inches, 197 pages. Price, $5.00.

Twenty-four of the country's leading authorities on the advantages and disadvantages of glass in present-day construction have contributed to this book. Although plastics are not covered specifically, much of the data contained herein would be applicable to plastics glazing as well as glass. Profusely illustrated, the work contains reports on the following general topics: daylighting, air conditioning, heating, ventilating, interior and exterior controls, window and glass production, and design.

"Plastic Tooling Shrinkage Test Method." Orville D. Lascoe. Research Report #6. ASTE Research Fund, 10700 Puritan Ave., Detroit 38, Mich. Paper, 8½ by 11 inches, 123 pages. Price, $4.00 to members of the American Society of Tool Engineers; $6.00 to non-members.

Orville D. Lascoe is a professor of industrial engineering at Purdue University. His study provides two satisfactory methods for measuring shrinkage in plastic tooling materials, and presents a true picture of what shrinkage is and how it occurs. Fully illustrated, it includes a summary of the six methods tried (including full details of their investigation). An equation is presented for predicting shrinkage after any known period, and the mathematical relationship between volumetric and linear shrinkage for a solid cylinder and a rectangular solid is established. In addition to photographs, a number of tables, graphs, and drawings are included.

"The Impact Test in Material Testing." (in German.) W. Spath. A. W. Gentner Verlag, Postfach 688, Stuttgart 1, Germany. 180 pages. Price, 21.50 DM (approximately $5.50).

The author covers the questions of tough and brittle breaks, plus the test methods used in this connection. He includes a comparison of such materials as plastics, steel, elastomers, sintered materials, hard metals, oxide-ceramic materials, coal, coke, concrete, abrasives, and glass. The book is actually sub-divided into three sections, the first covering specifications, test equipment, and measured results. The second part describes measurements taken by the author using a new impact tester which makes it possible to measure the maximum load occurring during impact. Conclusions are stated in the third section.

Congress has voted favorably on a major recommendation
of the bipartisan Hoover Commission
for a more businesslike budget procedure.

THANKS...AND WELL DONE!

PLASTICS TECHNOLOGY, a member of BILL BROTHERS PUBLICATIONS, expresses its appreciation to all who supported the Hoover Commission recommendation for modernized federal budgeting.

Congratulations to the senators who unanimously passed S.434 and to the representatives who overwhelmingly voted for H.R. 8002.

One victory can lead to another... let's keep the ball rolling for more efficiency and economy in government!

What next?

There's other work to be done, as has been noted in these messages. Your continued support is needed.

Target recommendations for this year include (1) a Congressional declaration against needless and costly government competition with private business; (2) modernization of federal personnel procedures and establishment of a senior administrative career service; (3) unified procurement and management of common-use Defense items under civilian control; and (4) coordination of the nation's complicated federal medical programs.

Readers who have already sent for literature (see coupon below) will be informed as additional Hoover Commission recommendations come before Congress for action.

If you have not yet signed up for the background information we invite you to do so at once on the coupon below. There is no cost, no obligation other than your own desire to help in the campaign for more efficient, more economical Federal Government.

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Abstracts of Important Articles

Materials

"The Properties and Fabricating of Nylon-11. Part I. Molding Powders," F. Chapman, *Plastics, (London)*, 22, 241, 406 (Oct. 1957).

Nylon-11, manufactured in France under the name Rilsan, is a polycondensation product of 11-amino undecanoic acid derived from castor oil. The different grades of molding powders, the injection molding techniques employed, the necessary modifications in design of injection cylinder and nozzle, as well as heat treatment, are discussed. The physical, mechanical, electrical and chemical properties of the material are described, with emphasis on the low specific gravity and low water absorption compared with other polyamides. Applications include gears, bearings, gaskets, sealing rings, and various articles in the electrical, chemical, and medical fields.

"Foamed-in-Place Techniques with Sebalkyd and Flexalkyd Resins," A. C. Cornwall, D. B. V. Parker, and L. N. Phillips, *Brit. Plastics*, 30, 9, 392 (Sept. 1957).

Formulations are given for obtaining various densities of rigid polyurethane foams from diisocyanates and Sebalkyd resins (sebacic/succinic/glycerol alkyd) and of flexible types using Flexalkyd resins (sebacic/adipic/glycerol alkyd). The discovery of a method of making easy-to-use, stable, pre-fabricated Flexalkyd has greatly simplified the production of flexible foams. Various foaming techniques are described, including open mold casting, precision foaming, frozen powder method, and two- and single-layer methods. A list of suitable pigments and dyestuffs for these foams is appended.

"Continuous Viscosity Measurements with an Oscillation Viscosimeter," I. Jakob, *Plaste u. Kautschuk*, 4, 6, 204 (June 1957).

Earlier theoretical considerations on the operation of an oscillation viscosimeter were checked experimentally. The method proved satisfactory with Newtonian liquids. For solutions of high polymers showing structural viscosity, characteristic peculiarities were observed. For example, the viscosity values obtained were very low as compared with those indicated by the Hoppler apparatus. These peculiarities are discussed in detail. In addition, the forces that occur at the individual macromolecules as a result of the shear oscillation, and eventually cause break-up of macromolecules, are estimated. (In German.)

"Dynamic Bending Strength of the Most Fragile Plastics and of other Materials," B. Bossu and P. Dubois, *Ind. Plastiques Mod.*, 9, 9, 44 (Nov. 1957).

This study aims chiefly at determining which of the different formulas considered best expresses the resistance to fracture under impact bending of materials that are more resistant to compression than tensile stress (such as polymethyl methacrylate, phenoplastics filled with wood flour, phenol-paper laminates, gray cast iron, and mineral glass). Tests were carried out at different striker speeds by the Charpy pendulum method; the apparatus used was equipped with a device for varying the distance between supports. (In French.)

"Stereospecific Catalysis and Isotactic Polymers," G. Natta, *Ind. Plastiques Mod.*, 9, 9, 51 (Nov. 1957).

The structure of isotactic, syndyotactic, and atactic polymers of olefins and conjugated diolefins is explained. In connection with the conjugated diolefins, reference is made to the preparation in Milan of 1,4-trans polyisoprene having the same structure as gutta percha. The conditions for stereospecific polymerization and the mechanism of the catalytic processes are discussed; the effects of cationic and anionic catalysts are compared; and stereospecific catalysts for isotactic polymers are indicated. The considerable theoretical and practical interest of diolefins with 1,2- or 1,4-cis structure is noted. The author also mentions the synthesis of certain stereoisomeric polymers of conjugated diolefins with complex catalysts containing transition elements and acting by an anionic mechanism. (In French.)

"Silicone Molding Powders," A. Langlade, *Ind. Plastiques Mod.*, 9, 9, 62 (Nov. 1957).

The electrical, physical, mehanical, and chemical properties of parts produced from silicone molding powders are examined, particularly as they are affected by temperature and aging. The variations in flexural strength and modulus of elasticity of a silicone and a phenolic molding powder are compared at elevated temperature. (In French.)

In the reference system used, the first number following the magazine name is the volume number, the second is the issue number (if any), and the third is the first page on which the abstracted article appears in that magazine.

Request for copies, reprints, or further information on any article abstracted in this department should be addressed to the publisher of the magazine where the article appeared. A complete listing of the publishers and addresses of these magazines is printed here quarterly.

The next complete listing will appear in June.

"Rheological Behaviour of Colloidal Systems," J. J. Ortega, *Rev. de Plasticos*, 8, 43, 3; 8, 44, 65 (Jan.-Feb. & Mar.-Apr., 1957).

After discussing the usual viscometric methods of determining flow characteristics of Newtonian fluids, the author describes a new rheometer for colloidal systems and gives details of tests performed on two asphaltic bitumens. (In Spanish.)

"High Temperature Insulating Materials in Aircraft Electrical Components," H. Wood, *Trans., Plastics Inst.*, 25, 61, 231 (July 1957).

There is a very wide gap between the performance of available insulating materials and the performance demanded by high operating temperatures of jet engines and supersonic speeds of jet airplanes. The author discusses the limitations and drawbacks of silicones for impregnation; vinyl acetal, asbestos, ethoxy resins and fluorocarbons for wire coverings; mica, Micanite, glass fabric and silicone-bonded glass laminates for sheet insulations; and silicone elastomers and fluorocarbons for flexible sleevings and moldings.

"Vulcanized Fiber and Vegetable Parchments," C. A. Redfarn, *Brit. Plastics*, 30, 9, 408, (Sept. 1957).

The history of vulcanized fiber and vegetable parchment is briefly reviewed, and the zinc chloride and sulfuric acid processes of preparation are discussed. Tables are given comparing the physical and electrical properties of zinc chloride vulcanized fiber and thick, special laminated, sulfuric acid and vulcanized fiber.

"Cross-linked Polystyrene for Electrical Purposes," W. Martens and G. Kannelbley, *Kunststoffe* 47, 9, 530 (Sept. 1957).

In recent years, interest in cross-linked polystyrene has increased in Germany. However, the German chemical industry has not produced it commercially as yet, apparently because the relatively small demand makes such a step uneconomical. Therefore, German requirements are filled by imports from the United States. Applications of the material in the United States and its properties are discussed. (In German.)

"Isotactic Polymers and Other Stereoisomeric Polymers," G. Natta, *Materie Plastiche*, 23, 7, 541 (July 1957).

This paper, presented in Paris in November 1956 at the 29th International Chemical Congress, examines the properties, structure, and crystallinity of various stereoisomers of polypropylene, polybutylene, and polybutadiene. Tables compare the mechanical and physical properties of isotactic polypropylene and polybutylene, and present X-ray data on their crystallinity, as well as that of polybutadiene. Referring to developments in the United States and Russia, Prof. Natta states his view that cis-1,4-polyisoprene is not the only and final solution for the synthesis of high grade synthetic rubber. He further foresees as the next step in stereospecific

polymerization the synthesis of crystalline oxygenated, chlorinated, and nitrated vinyl polymers with high fusion temperatures. (In Italian.)

"Expanded Polystyrene," A. Cooper, *Plastics, (London)*, 22, 242, 431 (Nov. 1957).

The properties of Polyzote, a British expanded polystyrene in the form of granules, are reviewed. Methods of pre-expanding and molding the materials are described, and some applications are mentioned.

"Graft Polymers. Part I," S. H. Pinner and V. Wycherley, *Plastics, (London)*, 22, 242, 456 (Nov. 1957).

This is the first of a series of articles on graft copolymers. The authors begin by discussing nomenclature, proposing a scheme for graft and block polymers, then deal with chemical methods of synthesis of non-random copolymers and graft copolymers from rubber.

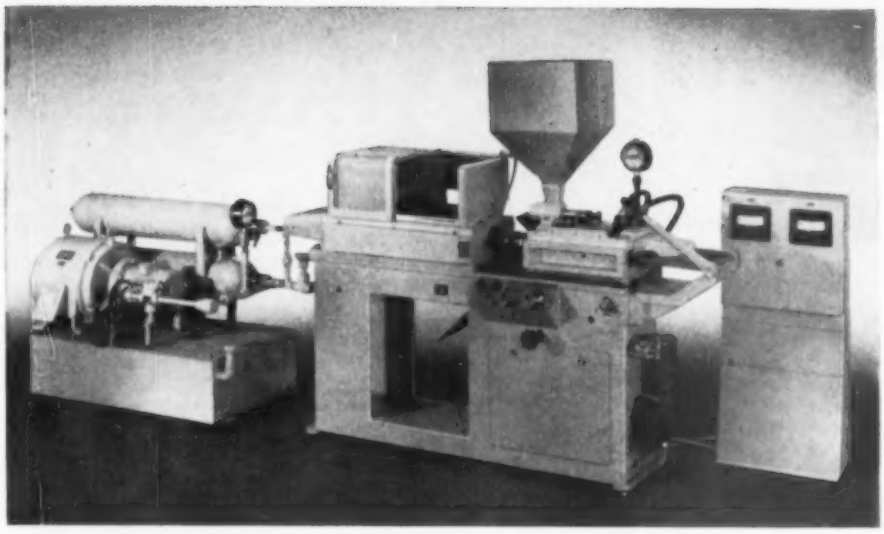
"A survey of Some Curing Methods of Polyester Resins," J. W. Cywinski, *Brit. Plastics*, 30, 10, 449 (Oct. 1957).

The methods of curing polyesters with the aid of a suitable catalyst are discussed. The mechanism of the catalytic action, the decomposition of organic peroxides, and the use of accelerators for this purpose are explained. The author suggests that cobalt octoate be used as an accelerator for ketone peroxides, instead of cobalt naphthenate. He examines room-temperature curing with methyl-ethyl ketone peroxide and cyclohexanone peroxide, and the effect on gel time of the inclusion of dimethyl aniline or dimethyl p-toluidine, various metal soaps, different types of peroxide catalysts, and varying amounts of catalyst and accelerator in formulations. Peak point is explained, and the behavior of a number of peroxides at different temperatures is illustrated. Curing at medium (35-90° C.) and high temperature (above 90° C.) is dealt with briefly, and the suitabilities of certain peroxides for high-temperature curing are compared.

"The Properties of Paste-Forming Types of PVC," D. Rysavy, *Kunststoffe*, 47, 12, 683 (Dec. 1957).

At the Brunn Research Institute for Macromolecular Chemistry, Czechoslovakia, the resistances of various types of PVC to the solvent action of plasticizers was investigated. The measurements obtained indicated that when the K-value of the PVC is between 65 and 80, the sole deciding factor for the rate of solution is the size of the area of contact between the resin and plasticizer; this, again, depends on the physical structure of the PVC particles. In the zone indicated, the degree of polymerization is of secondary importance. The usefulness of various types of PVC for making pastes (plastisols) is examined, and the influence of drying temperature on the properties of past-forming PVC prepared by drying the latex with a Nubilosa spray dryer is considered. (In German.)

"Ziegler Polyethylene," E. T. Barrows and E. Lelyveld, *Trans. Plastics Inst.*, 25, 62, 325 (Oct. 1957).



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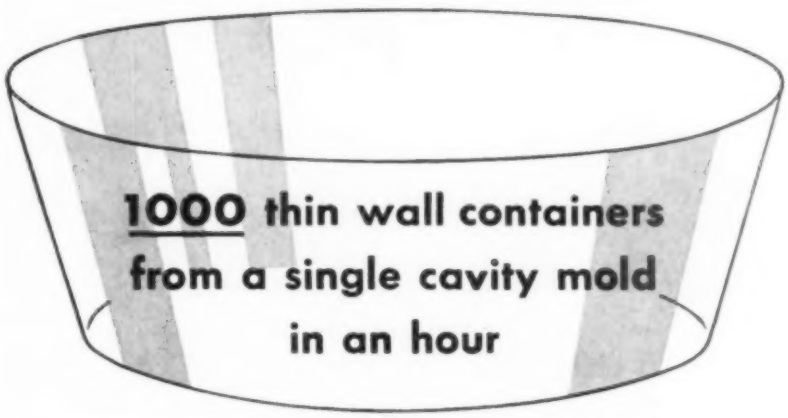

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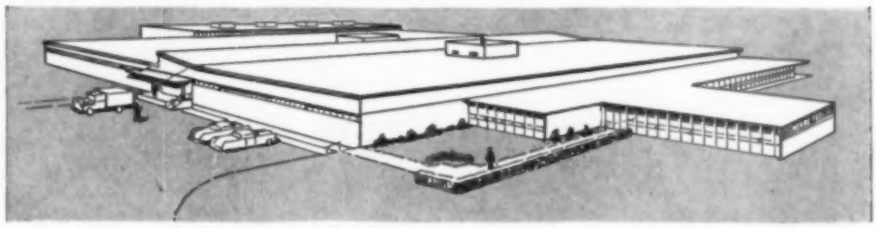

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Detailed information is given on the production of Ziegler polyethylenes, their properties, processing characteristics, and some of their applications.

"Investigation into the Structure of Polyamides, Especially of Nylon-6," F. Kessler, *Trans. Plastics Inst.*, 25, 62, 281 (Oct. 1957).

The paper chiefly concerns Nylon-6, produced by A.K.U., Arnhem, Holland, under the name, Akulon. Polyamides show a tendency toward crystallization, and the resulting spherulitic structures can be examined in microtome sections under the polarizing microscope. The author discusses the phenomenology of crystallization, the various structures occurring in the polyamide as seen under the microscope, and the factors determining these structures. These factors include heat treatment, processing conditions, temperature of cylinders and molds in injection molding, design of injection and extrusion machines, and pressure. The effect of the polyamide structure on the properties of the final products is explained, and some practical suggestions are given on the investigation of the structure of nylon articles and the indications provided by the structural pictures.

"Condensation of Melamine with Formaldehyde, with Special Consideration of the Variations in pH During the Reaction," H. Michaud, *Kunststoffe*, 47, 12, 686 (Dec. 1957).

This program was aimed at determining the factors that influence the course of pH and, hence, the rate of condensation in the reaction of melamine with formaldehyde. The following factors were found to be important in this regard: mol ratio of melamine and formaldehyde; presence of certain metal ions, oxygen, and hydrolysis or deamination products; size of melamine granules; and the salt content of the condensation solution. Keeping qualities also depend on the course of the reaction. (In German.)

"High Molecular Ester Plasticizers in Practice," K. Zohrer and A. Merz, *Kunststoff-Rundschau*, 4, 6, 233 (June 1957).

The special properties conferred by high-molecular ester plasticizers make them useful where the finished product must show good resistance to solvents and high temperature, and minimum tendency toward migration. The authors compare solubility, tendency to swelling, and migration of PVC prepared with such plasticizers and with dioctylphthalate. The data are tabulated, as well as data on compatibility with PVC and other synthetic resins. Trade names of different high-molecular plasticizers are listed, together with the names of their manufacturers and countries of origin. (In German.)

"Nuclear Magnetic Resonance as Means of Investigation in the Study of Macromolecules," G. Lanzavecchia, *Materie Plastiche*, 23, 7, 560 (July 1957).

The magnetic properties of nuclei and the conditions under which nuclear magnetic resonance occurs are considered briefly, and methods of using the new technique are explained. Examples are given of its application in studying fluorocarbon resin, polyamides, fusion phenomena, rubber-like polymers, vulcanization, and second-order transitions. (In Italian.)

Equipment

"Permeability to Gas and Liquids of Plastic Films," T. Sabbioni, *Poliplasti*, 5, 22, 4 (July-Aug. 1957).

After briefly reviewing certain fundamental aspects of the permeability of plastics to gas and liquids, the author describes the apparatus and technique he employs to measure this property for Fertene and Rotene (Montecatini high and low pressure polyethylenes, respectively). (In Italian.)

"A Simple Extensometer for Tensile Testing of Polymers," A. E. Eagles and A. R. Payne, *Rubber & Plastics Age*, 38, 9, 811 (Sept. 1957).

A new improved extensometer for tensile testing of polymers is described. Results of tests compare favorably with those obtained by a conventional method. It is concluded that the use of the prototype extensometer, which is a simple mechanical device that is reliable in operation, removes the last obstacle from autographic recording of tests using dumb-bell specimens, thus permitting a considerable increase in speed in tensile testing.

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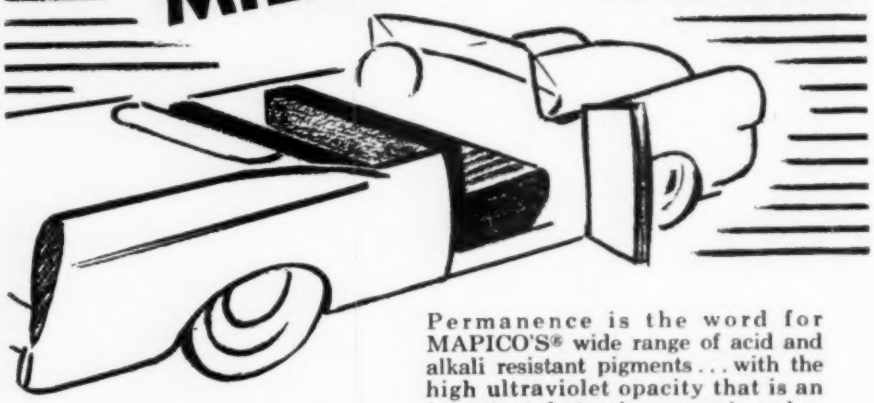

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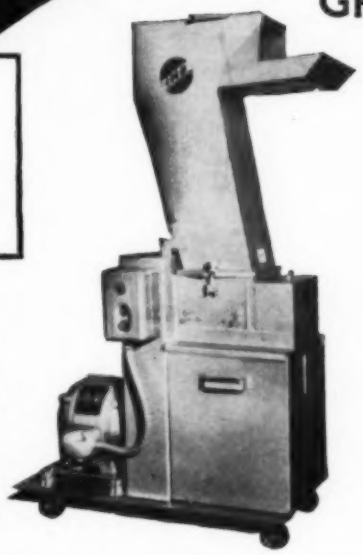

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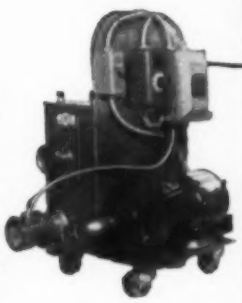

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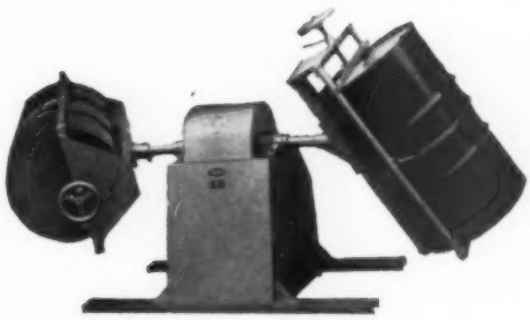

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"Apparatus for Determining the Distortion and Softening Temperature of Plastic Materials," N. Grandis, *Materie Plastiche*, 23, 7, 586 (July 1957).

Description and operation of a device for determining distortion and softening temperature of plastic materials according to A.S.T.M. Method D648-45 T, the German method VDE 0302 III 43, and the British specification BS2782, Part I. (In Italian.)

Processing

"Injection Molding of Plastic Spectacle Frames," M. Sirtoli, *Materie Plastiche*, 23, 7, 571 (July 1957).

Hints are given on the necessary conditions for successful injection molding of spectacle frames, and several types of molds are described. (In Italian.)

"Radiochemical Grafting of Monomers onto Polyethylene," A. Charlesby and S. H. Pinner, *Ind. Plastiques Mod.*, 9, 9, 30; 9, 10, 43 (Nov. & Dec. 1957).

After outlining some of the problems involved in polymer grafting, the authors deal with radiation sources, comparing the relative advantages of different radioactive isotopes, and electron accelerators. The operation of three types of accelerators (the van de Graaff, the linear accelerator, and the resonance transformer) are described, and the effects of radiation intensity are considered. The experimental results obtained on grafted materials prepared at different levels of radiation then are considered. In this connection, the compatibility of monomers, the rate of diffusion, and conditions under which grafting takes place are discussed. Finally, the rates of polymerization and grafting are compared. (In French.)

"Spark Machining in the Die-Making Industry," A. D. P. Tallents, *Trans. Plastics Inst.*, 25, 61, 217 (July 1957).

By spark machining, the author means the controlled removal of metal from its parent body by bombarding the surface with electric sparks. The principal features of spark-machining equipment and techniques are discussed and, in particular, a British multi-head design that is newer than any other known to be made outside the Iron Curtain countries (where this development is being pursued intensively). The multi-head unit duplicates, even quadruplicates, work stations from one initial power-pack cabinet. The application of the technique to die-making and the problems involved are dealt with, and special consideration is given to electrode design and wear, and cavity work.

"The Properties and Fabricating of Nylon-11. Part 2. Extrusion," F. Chapman, *Plastics (London)*, 22, 242, 461 (Nov. 1957).

Nylon-11 is the French superpolyamide, Rilsan. The conditions for satisfactory extrusion of wire coating, pipe, tube, film, monofilaments, and blanks for blown bottles are considered, and the properties of the products are described.

"The Production of Optical Lenses by Injection Molding," H. Spies, *Plastverarbeiter*, 8, 6, 205 (June 1957).

Discussion of the precautions to be taken to obtain satisfactory results in the injection molding of optical lenses. (In German.)

Applications

"Thermoplastics in the Submarine Cable Industry," Sir John Dean, *Trans. Plastics Inst.*, 25, 61, 171 (July 1957).

This is the Eighth Annual Lecture of the Plastics Institute after reviewing the history of gutta percha in submarine cables and the developments necessitating its replacement by another material, the author relates how and why polyethylene paved the way for those advances in underwater telecommunication which eventually led to the production of the first transatlantic telephone cable. Details are given of the construction and testing of this cable, also on jointing of cables, air-spaced cables, high-voltage submarine power cables, and the use of expanded polyethylene.

"The Industrial Application of Terylene Polyester Fiber," J. R. A. Kennedy, *Trans. Plastics Inst.*, 25, 61, 191 (July 1957).

Following a description of the discovery, manufacture, and chemical and physical properties of Terylene polyester fiber, the advantages are considered for various industrial applications such as conveyor belting, V-belts, laminates, and general industrial textiles for electrical purposes, paper-making felts, filter cloths, tow-ropes, etc.

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Patent Digest

Materials

Modified Polyvinyl Alcohol Polymers and Their Preparation. No. 2,816,087. Harry W. Coover, Jr., Kingsport, Tenn. (to Eastman Kodak Co., Rochester, N. Y.).

The end product is a water-soluble graft copolymer of polyvinyl alcohol and a monoethylenically-unsaturated vinylidene chloride monomer.

Modified Phenolic Resin Compositions. No. 2,816,085. Thomas Anas, Springfield, and Stuart H. Rider, Longmeadow, Mass. (to Monsanto Chemical Co., St. Louis, Mo.).

The composition contains 100 parts of a permanently-fusible condensation product of 0.65-0.95 mol of formaldehyde with a mole of phenol and a cresol, xylenol, naphthol, resorcinol, or phloroglucinol; and 5-100 parts of a guanamine compound taken from the group consisting of benzoguanamine, phenyl acetoguanamine, and their N-methylol derivatives.

Production of Substantially Pure Vinyl Chloride. No. 2,816,148. Irving F. Anderson, Hopewell, and Richard C. Datin, Petersburg, Va. (to Allied Chemical Corp., New York, N. Y.).

Acetylene and hydrogen are reacted catalytically to produce an anhydrous, gaseous stream of crude vinyl chloride. This stream contains by-products with higher boiling points than vinyl chloride, plus unreacted acetylene and hydrogen chloride. The stream is cooled to a temperature above the condensation point by direct contact with an inert, anhydrous, non-volatile liquid; after which it is distilled under reflux to separate the last three items from the by-products. This vaporous overhead is then flashed to give a separable bottom layer of substantially pure vinyl chloride.

Process of Preparing Phenol-Dichlorophenol Formaldehyde Resins. No. 2,814,607. George M. Wagner, Lewiston, N. Y. (to Olin Mathieson Chemical Corp., New York, N. Y.).

The resinous compounds are the formaldehyde condensation products of a phenolic component, which consists essentially of 15-90 mole percent of phenol and 10-85 mole percent of mixed dichlorophenols.

Process of Polymerizing a Fluoroethylene in Water Containing a Chlorendic Ac'd Compound. No. 2,816,082. Keith Clark Brinker, Fairfax, Wilmington, Del., and Robert Macdonald Ross, Binghamton, N. Y. (to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.).

To obtain a colloidal dispersion of polymer, fluoroethylenes are polymerized in an aqueous medium and in the presence of water-soluble initiator and 1% by weight of 1,4,5,6,7,7,-hexachlorobicyclo-(2,2,1)-5-heptene 2,3-dicarboxylic acid as the dispersing agent.

Terpolymer of Methylstyrenes. No. 2,816,095. Donald L. Swanson, Stamford, Conn. (to American Cyanamid Co., New York, N. Y.).

About 25-40% orthomethylstyrene, less than 5% metamethylstyrene, and 60-75% paramethylstyrene are heated in an inert atmosphere to produce polymerization.

Compositions Comprising Diisocyanate-Linked Elastomers and Silicon Dioxide. No. 2,814,604. No. 2,814,604. Robinson F. Nichols, Cuyahoga Falls, O., and Robert O. Weisz, Fort Wayne, Ind. (to B. F. Goodrich Co., Akron, O.).

Polyesters prepared by the condersation reaction of a dibasic aliphatic acid and a molar excess of glycol; polyesteramides which are obtained by condensation reactions of a dibasic aliphatic acid with a molar excess of glycol, amino alcohols, and aliphatic diamines; or polyalkylene ether glycols are reacted with an aromatic diisocyanate in equal molar proportions. One-hundred parts by weight of this material is then reacted with 5-50 parts of silicone dioxide particles having an average particle size of 50-600 millimicrons.

Coating Compositions Containing an Epoxy Resin, a Methylol Substituted 2-Alkenyloxybenzene, and a Butylated Urea-Formaldehyde Resin. No. 2,816,084. Louis J. Nowacki, Bexley, O. (to Synthetasine Protective Coatings, Inc., New York, N. Y.).

The composition consists of an epoxide resin which is a condensate of epichlorhydrin and a dihydric phenol; an alkenyloxybenzene containing three methylol groups; and 2-20% of a butylated urea formaldehyde resin.

Stabilized Acrylonitrile Polymers. No. 2,813,845. George L. Wesp, Englewood, and Robert J. Slocombe, Dayton, O. (to Monsanto Chemical Co., St. Louis, Mo.).

The polymer comprises 20-100% acrylonitrile and up to 80% of another monoolefinic monomer, containing intimately dispersed therein 0.01-10% of magnesium chloride, sulfate, or nitrate.

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—The Editor

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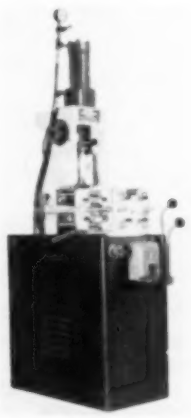

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Patent Digest (Cont'd.)

Boron-Adsorbing Resin and Process for Removing Boron Compounds from Fluids. No. 2,813,838. William R. Lyman, Abington, and Alfred F. Preuss, Jr., Hatboro, Pa. (to Rohm & Haas Co., Philadelphia, Pa.).

The resinous product which is capable of removing boron compounds from solutions consists of an insoluble, cross-linked copolymer of an aromatic hydrocarbon with a vinyl group as its sole aliphatic unsaturation and a copolymerizable cross-linking agent.

Foundry Sand Binder and Process of Preparation. No. 2,813,840. Harold K. Salzberg, Bainbridge, N. Y., (to Borden Co., New York, N. Y.).

The binder composition comprises 0.25-5 parts by weight of starch and water, 0.01-0.1 part of paraffin wax, and 0.25-5 parts resin. The latter is a water-soluble urea- or phenol-formaldehyde condensation product; and the wax is vaporizable, in part, at the temperature for casting metal against foundry sand. It decomposes under heat to give carbon at 1,000° F., and is dispersed in emulsified form as the discontinuous phase in the water.

Alkyd Resin Comprising Tall Oil and Pentaerythritol. No. 2,813,841. John A. Parker, Lancaster Township, and Ernest J. Pieper, Lancaster, Pa. (to Armstrong Cork Co., Lancaster, Pa.).

A mixture of tall oil, dimerized glyceride oil fatty acids, and a polyhydroxy alcohol containing at least one ether linkage are reacted to give a product with an acid number of 140-160. This is reacted with pentaerythritol to give an alkyd with an acid number of 15-25. Finally, this product is reacted with an enedioic dicarboxylic acid to produce a product with an acid number of 20-30.

Thermal Polymerization of Acrylonitrile, Methacrylonitrile, Styrene, and Alkyl Methacrylates, Using Thiuram Disulfides as Initiators. No. 2,813,849. Roland J. Kern Miamisburg, O. (to Monsanto Chemical Co., St. Louis, Mo.).

One of the above-mentioned monomers whose alkyl group contains 1-10 carbon atoms is heated in the presence of small, but catalytic amounts of a thiouram disulfide compound.

Cellular Resins from Arylene Diisocyanates and Polysulfide Polymers and Method of Making Same. No. 2,814,600. Andrew Mitchell, La Canada, Calif. (to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.).

Water is reacted with a fluid polythiourethane, which has been formed by condensing an arylene diisocyanate and a liquid polysulfide polymer having terminal sulfhydryl groups and a molecular weight of 1,000-4,000. The end product is a cellular rubber-like material.

Plasticized Vinyl Polymers Containing Alkoxychlorobenzenes. No. 2,814,602. Gordon K. Storin, Niagara Falls, N. Y., and Francis E. Lawlor, Philadelphia, Pa., and Ferri Casciani, Lewiston, N. Y. (to Hooker Electrochemical Co., Niagara Falls, N. Y.).

Alkoxychlorobenzene improves the flame resistance of plasticized, substantially polymerized PVC compounds.

Sheeting Die. No. 2,813,301. William Murray Underwood, Springfield, Mass. (to Monsanto Chemical Co., St. Louis, Mo.).

The sheet-extrusion die comprises adjustable die lips; a primary material chamber with aperture to the die lips, thus constituting an extrusion orifice; a secondary material chamber to the rear of the first and co-extensive therewith; an adjustable aperture defining a constricted passage between chambers; and a means for introducing material into the second chamber.

Method of and Apparatus for Homogenizing Plastic or Plasticizable Materials. No. 2,813,302. Howard G. Beck, Wabash, Ind. (to General Tire & Rubber Co., Akron, O.).

The homogenizer and extruder consists of coaxial inner and outer rotatable members; the exterior surface of the inner and the interior surface of the outer conforming to coaxial complemental- and closely-spaced surfaces of revolution. Axially-opposed rib portions form circumferential flow-directing channels, which act as walls of a tortuous annular passageway for materials. Rubbing between surfaces homogenizes the material as it is directed forward.

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Equipment

Injection Molding Apparatus. No. 2,814,831. Robert B. McKee, Jr., Midland, Mich. (to Dow Chemical Co., Midland, Mich.).

The mold, which is adapted for injection molding, has a front and rear wall. A recess in its front surface has an inner end to provide a relatively thin and flexible segment, and is defined by a shallow gate. The injection nozzle has a spout which is insertable in the recess, and which projects from a peripheral shoulder. This shoulder is commensurate in length with the depth of the recess, and is adapted to abut against and engage the front wall by the aforementioned recess. This aligns and supports the nozzle against the mold, and the spout is in sealing contact at the inner end of the recess. The nozzle communicates then with the gate.

Double Cylinder and Ram-Type Plastic Mixing Apparatus. No. 2,813,300. John M. Hausman, Stow, Ohio.

This apparatus comprises a pair of radially-spaced, concentric, aligned, hollow cylinders; a closure for one end of each cylinder; a ram which goes through the cylinders; and a ram adapted to reciprocate in the space between the cylinders. The inner cylinder has apertures adjacent to its closed end for passage of plastic material to the other cylinder. This flow is actuated by opposite movement of the reciprocating ram.

Vacuum Molding Machine. No. 2,814,-074. Robert Lawrence Butzko, Bridgeport, Conn. (to Auto-Vac Co., Bridgeport, Conn.).

Parts include: a main frame; a pair of parallel, transversely-spaced longitudinal trackways; a heater unit half the length of the frame; roller supports for the heater which engage the trackways; a horizontal vacuum plate; a clamping frame; a lever bar which is pivotally connected to the main frame in back of the clamping frame; and a second lever bar pivotally connected to both sides of the lower clamping frame. The clamping frame thus remains in a horizontal position as it is raised and lowered.

Molding Apparatus. No. 2,813,303, George M. Stevenson and Carroll E. Stevenson, Baltimore, Md. (to Edwin E. Stevenson, Baltimore, Md).

The machine comprises a molding head with a pair of aligned molding elements; a means for moving the head along a fixed path; a means for dispensing material to one of the molding elements; and two unidirectionally-moving, rotatable conveyor means disposed along the path for carrying the molding elements to molding engagement, and for separating them.

Arrangement in Calenders. No. 2,813,357. Gunnar I. Fredholm, Bromma, Sweden. (to Verkstads Aktiebolaget Calor, Bromma, Sweden).

The machine has a heated bed which holds a freely-rotatable calender roll. This roll has end walls, a perforated cylindrical casing, a cylindrical pervious padding for encasing the roller, a driving means, and a universal joint for connecting the roller with the hub portion. A hub sleeve with air passage is provided, plus a suction device for withdrawing air from the roller.

Processing

Methods and Means for Manufacturing Individual Condiment Dispensers. No. 2,-813,799. Sydney E. Bender and Lenore B. Donnelly, Denver, Colo.

A number of indented cavities are formed in a thermoplastic sheet; these cavities being interconnected by indented necks. A sheet of thermoplastic material is placed over the indented sheet and thermo-welded to it, thus providing a multiple-cavity assembly. Condiment is forced between the layers by way of the interconnecting necks; the necks are thermo-welded; and the individual patties are stamped from the sheet.

Pipelaying Method. No. 2,816,322. Johan Bjorksten, Madison, Wis.

Synthetic resin tubing is extruded from an extruder moving parallel to a receiving trench. Between the die and the trench, the extrudate is formed into a loop that is supported at two points by traveling means moving in conjunction with the extruder.

Method of Making Plastic Lined Concrete Pipe and Joints Therein. No. 2,816,-323. Charles G. Munger, San Gabriel, Calif.

A sheet of gas-impermeable and corrosion-resistant thermoplastic material is wrapped about a form with a smooth surface in contact herewith. Adjacent edges of the sheet are bonded to form a fluid tight seal, after which concrete is molded about the tube in interlocking relationship with projections on the outer surface of the sheet.

Method of Producing Foams from Self-Frothing Silicon Resins. No. 2,813,839. John B. Rust, Verona, N. J., and Leonard Spialter, Allston, Mass. (to Montclair Research Corp. and Ellis-Foster Corp., N. J.).

An organo-silicon oxide froth is obtained by heating a self-frothing silane selected from the group consisting of n-butyl-triacetoxy silane, tetrakis silane, methyl di-beta-chloroethoxy silane, dimethyl diethoxy silane, and methyl triacetoxy silane. The froth is cured at a temperature around 250-550° C.

Method of Embossing Thermoplastic Fabrics. No. 2,814,077. Leslie John Moncrieff, London, England. (to British Celanese, Ltd., Great Britain).

The thermoplastic fabric is softened temporarily by contact with a perforated, heated pattern while it is wet with a liquid which aids in its softening. The fabric is forced into over-all contact with the pattern by drawing an elastic membrane down upon it. Suction operates through perforations in the pattern and interstices in the fabric. It is then cooled and separated from the pattern.

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Patent Digest (Cont'd.)

Packaging Process and Apparatus. No. 2,816,837. Henry T. Holsman, Santa Barbara, Calif.

Sterilized substances are introduced aseptically into an extruded plastic tube that has been rendered sterile by the heat of extrusion. At predetermined intervals, the filled tube is compressed from opposite sides and heat is applied to seal the walls together at the points of compression. This operation forms the tube into a series of sealed containers which may be separated at the sealed portion.

Processing of Polyurethane Polymers. No. 2,814,605. Frederic B. Stilmar, Wilmington, Del. (to E. I. du Pont de Nemours & Co., Wilmington, Del.).

A plasticizer, prepared by the reaction of a polytetramethyleneether glycol with 2,4-tolylene diisocyanate is incorporated in a stable, uncured polyurethane polymer containing substantially no free isocyanate groups. The polymer is cross-linked by the addition of 1-20% by weight of an organic diisocyanate, after which the mixture is heated to a temperature between 90-150° C. to produce a cured elastomer.

Electrical Connector. No. 2,818,363. Harold O. Wooley, Jr., Hershey, Pa. (to AMP, Inc., Harrisburg, Pa.).

An adhesive lacquer is applied to a steel sleeve and cured. A nylon sleeve is fitted tightly over the steel one, and the assembly is placed in a high-frequency induction field long enough to melt the interface between the two. The sleeves are chilled to bind the nylon to the steel, and the assembly is placed over a metal ferrule to form an insulated conductor.

Porous Articles of Fluoroethylene Polymers and Process of Making the Same. No. 2,819,209. David B. Pall, Roslyn Heights, and Sidney Krakauer, Franklin Square, N. Y.).

A fluid-permeable filter is made by sintering a layer of fluoroethylene polymer particles that are confined between inert, non-adhering surfaces. The particles are maintained at a pressure between 30-50 psi., above the softening temperature, but below the melting and decomposition temperatures of the polymer.

Applications

Polyethylene Terephthalate Tobacco Smoke Filter. No. 2,818,868. Joseph T. Rivers, Jr., West Chester, Pa. (to E. I. du Pont de Nemours & Co., Wilmington, Del.)

Polyethylene terephthalate filaments, having a denier per filament between 0.1-10, are retained in a tube to form a tobacco smoke filter.

Magnetic Recording Tape. No. 2,819,186. Ernest W. Franck, Glenbrook, Conn. (to Reeves Soundcraft Corp., New York, N. Y.).

A magnetic recording tape for recording high frequency impulses above the audio frequency range consists of a composite coating of two adherently-bonded layers of resinous polymeric material supported by a strip of non-magnetic film. The outer resin-layer, which is not thicker than 0.25 mil, contains a dispersion of finely divided magnetic material. The inner layer is non-magnetic, relatively soft, and flexible.

Plastic Building and Construction. No. 2,816,329. Louis S. Sogaro, East Paterson, N. J.

The arched sides and roof are formed of plastic concavo-convex panels, which interlock by means of inner and outer flanges. Each panel also is furnished with a reinforcing rib between and parallel to the side flanges. Additional flanges, which are found at the bottom of the longitudinal panels, connect to a footing disposed along each side of the building. Some of the panels are supplied with ventilating openings, and are surrounded by collars and telescoping closure caps which provide a weather seal. Panels having straight margins form the door opening, the frame of which attaches to the side flanges on the aforementioned panels.

Plastic Nozzle or Spout Mounting and Method of Forming Same. No. 2,815,894. John Henchert, River Forest, Ill. (to Continental Can Co., New York, N. Y.).

The nozzle comprises a tubular body including mounting flange and cylindrical base portion. The metal mounting wall has a recess for the annular nozzle seat. An annular anchoring means extends over and presses against the mounting flange to hold it in the nozzle seat.

Plastic Structural Members and Method for Making. No. 2,814,842. William Donald O'Morrow, La Jolla, Calif. (to Chemiglas, Inc., San Diego, Calif.).

The window canopy is composed of reinforced plastic end brackets for holding a sliding corrugated top.

Boat Construction. No. 2,816,298. Joseph F. Foster, Portsmouth, O.

The boat hull consists of an outer skin and an inner shell of resin and fiberglass. The two structures are separated by a corrugated filler which is bonded to each, and forms a series of closed air spaces between them. The filler supports a frame located at the upper edges of the shell. A keel is bonded to the outer skin, and transverse ribs are bonded to the inner shell.

Decorative Laminate Containing a Transparent Printed Overlay Sheet. No. 2,816,851. Hanns F. Arledter, Stockbridge, Mass. (to Hurlbut Paper Co., South Lee, Mass.).

The transparent overlay sheet consists of an interfelted, fibrous web made from various percentages of: cellulose and rayon fibers, having a length greater than six millimeters and a denier less than 1.5; glass fibers, having a diameter from 0.2-2 microns; and a laminating resin.

Packaged Thermoplastics. No. 2,806,595. Robert W. Spake, Plainfield, N. J. (to L. A. Dreyfus Co., Oak Tree, N. J.).

Thermoplastics are packaged within a container having a separable polyvinyl alcohol liner. The thermoplastics are in intimate contact with, and stick to the liner, which is substantially infusible and insoluble in water at temperatures between 32-150° F. The polyvinyl alcohol is substantially stable at ambient temperatures.

Plastic Shelter. No. 2,809,649. Milton G. Druck, Portland, Ore. (to Plastimayd Products Corp., Portland, Ore.).

A maintenance tent for use in repairing overhead utility lines and cables comprises sheets of low-temperature translucent vinyl divided into side sections and a top. The tubular metal frame that supports the vinyl carries a pair of depending arms for engaging one of the cables. Snap fasteners secure the component plastic sheets to each other and to the frame. A T-shaped slot is formed in two of the opposite sides of the tent for accommodating one or more lines of cables. Grommets are provided on the marginal edges of the slots to receive a rope which is used to control the size of the slot in accordance with the diameters of the cables which must be accommodated. Flaps are fastened along the upper edges of the slots to cover them when not in use.

Impermeable Polyethylene Film and Containers and Process of Making Same. No. 2,811,468. Stephen P. Joffre, Little Falls, N.J. (to Shulton, Inc., Clifton, N.J.).

A polyethylene container whose walls are sufficiently fluorinated to render them impermeable to the passage of the light notes of perfume compositions. The fluorine content is limited to a quantity not greater than 3.5% by weight.

Plastic Boat. No. 2,807,811. Herbert J. Atkinson, Sudbury, and Sherwin M. Coan, Lancaster, Mass. (to Sherwin M. Coan, Lancaster, Mass.).

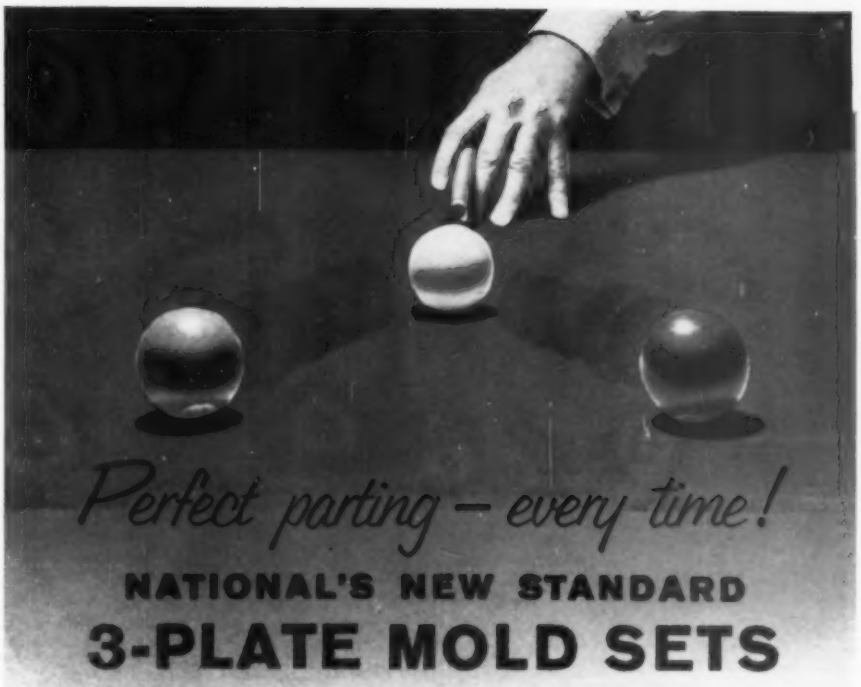
The boat comprises a single piece of plastic material having integral sidewall and bottom structures. A corrugation, running longitudinally along the inner bottom, forms a recess for a reinforcing bar which is held in place by a corrugated strip co-acting with the recess. Additional, longitudinally-recessed stiffening strips are secured to the outer bottom surface of the boat in spaced relationship with the central stiffener.

Laminated Grinding Wheel. No. 2,808,688. Harry Douglas MacMaster, Bryn Athyn, Pa. (to Grinding Wheel Corp., Philadelphia, Pa.).

The wheel comprises a matrix which includes a synthetic resin; abrasive grains; a felted, fibrous material randomly disposed laminarly in the matrix; and an open mesh fabric of non-metallic reinforcing material disposed in one plane of the matrix.

Method of Making a Composite Golf Shaft for a Golf Club. No. 2,809,144. David L. Grimes, San Diego, Calif. (to Narmco Sporting Goods Co., Costa Mesa, Calif.).

A mandrel coated with a parting agent is attached to a hollow metal insert that has been coated with a structural metal adhesive. A glass fabric cloth, impregnated with a thermosetting phenolic resin, is wrapped around the insert and mandrel. Cellophane is wrapped around the cloth layers and the combination is heated until the phenolic has set after which the mandrel is removed.



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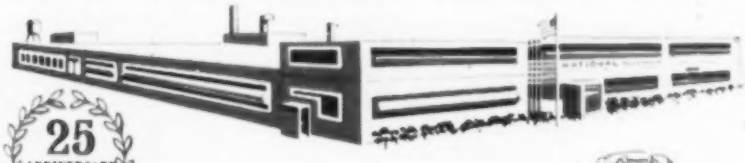

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CALENDAR of COMING EVENTS

May 21

SPE New York Section. Governor Clinton Hotel, New York City.

Vinyl Group. First meeting—Topic is Stabilization. Governor Clinton Hotel.

Thermo-forming Group. Governor Clinton Hotel.

May 22

SPE Binghampton Section. Vestal Steak House, Binghamton, N. Y.

May 26-30

27th Annual National Packaging Exposition. Coliseum, New York City.

June 9

SPE Buffalo Section. Park Lane Restaurant, Buffalo, N. Y.

Chicago Section. Western Society of Engineers Bldg. Chicago, Ill.

Cleveland-Akron Section. Spanish Tavern. Brecksville, O.

June 9-12

1958 Microscopy Symposium. Del Prado Hotel, Chicago, Ill.

June 9-21

Triennial meeting, Int'l. Organization for Standardization. Harrogate, England.

June 11-14

National Society of Professional Engineers. Annual meeting. Chase, and Park Hotels, St. Louis, Mo.

June 12-14

86th Annual Meeting. Manufacturing Chemists' Association. The Greenbriar, White Sulphur Springs, W. Va.

June 15-19

Semi-annual meeting. ASME. Hotel Statler, Detroit, Mich.

June 19

SPE Eastern New England Section. Hotel Beaconsfield, Brookline, Mass.

Pittsburgh Section. Cappy's Restaurant, Pittsburgh, Pa.

June 22-27

Annual meeting. ASTM. Hotel Statler, Boston, Mass.

Aug. 4-8

1958 Gordon Research Conferences on Elastomers and Polymers. University of Rhode Island. Colby Junior College, New London, N. H.

Sept. 12

SPE Detroit Section. Regional Technical Conference. Plastics in Automotive Applications. St. Clair Inn, St. Clair, Mich.

Domestic Production and Sales of Plastics and Resin Material, 1957 Totals and January, 1958

Following are the preliminary 1957 totals and the estimated January, 1958 statistics for domestic production and sale of plastics and resinous materials. Units listed are in pounds, dry weight, unless otherwise specified. Data on alkyds and rosin modifications have not been included since their use is primarily restricted to the protective coating industry.

Both production and sales of cellulosics increased slightly above the 1956 totals, but the January period shows a small dip. Phenolics are moving more slowly, as are ureas, melamines, and styrenes. Vinyls and vinyl chlorides reflect significant increases, in both the overall totals and in January. Coumarone-indene, polyesters, and polyethylene are up, as well as all of the miscellaneous items. Overall production figures are up about 150-million pounds; sales about 700-million pounds.

	Preliminary Totals, 1957		January, 1958	
	Production	Sales	Production	Sales
Cellulose Plastics:[1]				
Cellulose acetate and mixed ester:				
Sheets, under 0.003 gage	18,568,493	18,029,640	1,288,978	1,214,284
Sheets, 0.003 gage and over	18,447,919	17,029,656	1,498,848	1,199,195
All other sheets, rods, and tubes	7,573,480	7,236,344	634,673	556,856
Molding and extrusion materials	94,192,792	93,021,901	6,138,117	6,443,269
Nitrocellulose sheets, rods, and tubes	3,972,223	4,114,144	347,777	376,441
Other cellulose plastics	5,357,730	4,738,294	8731,721	693,027
TOTAL	148,112,637	145,057,179	10,782,114	10,473,072
Phenolic and Other Tar-Acid Resins:				
Molding materials[1]	184,243,012	177,103,173	15,637,395	13,003,267
Bonding and adhesive resins for—				
Laminating (except plywood)	59,327,717	46,545,886	4,997,127	3,219,645
Coated and bonded abrasives	16,787,681	16,554,519	1,247,872	915,677
Friction materials (brake linings, clutch facings, and similar materials)[7]				
Thermal insulation (fiber glass, rock wool)	51,846,929	51,823,994	4,346,400	3,685,869
Plywood	46,110,286	36,212,793	4,068,726	3,546,982
All other bonding and adhesive uses	57,873,249	55,757,965	5,335,210	4,593,183
Protective-coating resins, unmodified and modified except by rosin	29,948,788	24,791,180	2,292,458	2,091,595
Resins for all other uses	36,745,411	30,707,599	2,648,417	1,995,791
TOTAL	482,883,073	439,497,109	40,573,605	33,052,018
Urea and Melamine Resins:				
Textile-treating and textile-coating resins	35,994,531	34,668,435	3,176,613	3,031,769
Paper-treating and paper-coating resins	24,324,169	22,889,965	1,660,588	1,799,663
Bonding and adhesive resins for—				
Plywood	96,266,062	93,367,123	7,558,202	6,818,934
All other bonding and adhesive uses, including laminating	33,361,643	30,890,077	2,862,043	2,639,142
Protective-coating resins, straight and modified	36,441,385	27,430,062	2,615,959	1,926,208
Resins for all other uses, including molding	89,195,553	90,547,296	8,951,057	8,914,547
TOTAL	315,583,343	299,792,958	26,824,462	25,128,263
Styrene Resins:				
Molding materials[1]	415,043,547	399,702,034	28,549,783	31,595,991
Protective-coating resins, straight and modified	83,926,261	78,069,792	7,689,571	7,233,175
Resins for all other uses	146,756,894	120,979,021	13,084,716	10,684,523
TOTAL	645,726,702	598,750,847	49,324,070	49,513,689
Vinyl and Vinyl Chloride Resins:[2]				
Polyvinyl chloride and copolymer resins (50% or more PVC) for—				
Film (resin content)		73,572,560		5,870,418
Sheeting (resin content)		56,525,317		4,119,278
Molding and extrusion (resin content)		215,022,930		16,361,113
Textile and paper treating and coating (resin content)[3]		66,447,454		4,035,242
Flooring (resin content)		81,376,318		7,561,963
Protective coating (resin content)		31,519,543		2,884,703
All other uses (resin content)		67,673,541		4,070,853
All other vinyl resins for—				
Adhesives (resin content)		41,882,867		3,211,581
All other uses (resin content)		112,996,232		10,779,709
TOTAL	829,984,805	747,016,762	68,974,884	58,894,860
Coumarone-Indene and Petroleum Polymer Resins	251,018,090	249,518,662	18,519,497	18,506,092
Polyester Resins	91,181,815	83,092,073	7,259,775	6,594,183
Polyethylene Resins	694,487,127	650,481,045	69,522,264	62,630,903
Miscellaneous Synthetic Plastics and Resin Materials:				
Molding materials[1, 4]	48,855,232	48,007,930	3,522,317	3,651,986
Protective-coating resins[5]	13,216,729	6,364,338	1,076,469	641,402
Resins for all other uses[6]	134,205,402	116,694,798	10,885,396	8,983,492
TOTAL	196,277,363	171,067,066	15,484,182	13,276,880
GRAND TOTALS	3,665,254,955	3,863,687,700	307,264,853	278,069,960

[1]Includes fillers, plasticizers, and extenders.
[2]Production statistics by uses are not representative, as end use may not be known at time of manufacture.
[3]Includes data for spreader and calendering-type resins.
[4]Includes data for acrylic, nylon, silicone, and other molding materials.
[5]Includes data for epichlorohydrin, acrylic, silicone, and other protective-coating resins.
[6]Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.
[7]Included with "All other bonding and adhesive uses."
SOURCE: United States Tariff Commission, Chemical Division.

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